Draft
Environmental Assessment
Mather Point Orientation/Transit Center and Transit System

GRAND CANYON

National Park • Arizona

United States Department of the Interior • National Park Service

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NATIONAL PARK SERVICE
Grand Canyon National Park
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N REPLY REFER TO

Draft Environmental Assessment
Mather Point Orientation/Transit Center and Transit System

GRAND CANYON
National Park
Coconino and Mohave Counties, Arizona
March 1997

This draft environmental assessment describes the National Park Service's proposal to construct the Mather Point Orientation/Transit Center and Transit System as described in the approved 1995 *General Management Plan/Final Environmental Impact Statement*, Grand Canyon National Park. Alternatives for this project were developed to implement a portion of Phase I of the approved 1995 GMP.

This draft environmental assessment is being released for a 30-day public review without a preferred alternative. Following the review period, a final environmental assessment with a preferred alternative will be prepared and made available for a 30-day public review. It is anticipated the final environmental assessment will be released in early to mid summer, 1997.

This draft environmental assessment analyzes the impacts of taking no action and three action alternatives. Common to all action alternatives is the development of the Mather Point Orientation/Transit Center. The three action alternatives differ in the number of private automobiles accommodated at the Mather Point facility and the mode of transportation between Tusayan and Mather. Alternatives were developed to address pertinent visitor needs and management issues, and to conserve resource values.

The action alternatives foster and promote an enhanced visitor experience and offer differing transportation methods to achieve this goal; transportation vehicles include shuttle buses and light rail. There alternative transportation methods were developed under the assumption that the U.S. Forest Service would complete its environmental impact statement (EIS) on the Tusayan Land Exchange, which includes the Gateway facility.

The 30-day public review period for this draft environmental assessment ends on April 16, 1997. All comments must be received by that time and should be addressed to

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SUMMARY

This environmental assessment analyzes the transit alternatives for visitor transportation on the South Rim of Grand Canyon National Park and the infrastructure and facilities proposed for the Mather Point orientation and transit center. These options are to implement a portion of the approved 1995 *Final General Management Plan / Environmental Impact Statement* at the Mather Point on the South Rim of Grand Canyon National Park, Arizona. The final plan and environmental impact statement was released in July 1995, and the record of decision was approved on August 21, 1995.

The general management plan called for construction of a facility near Mather Point to function in orienting visitors to sites and experiences on the South Rim. The plan also stated that most South Rim visitors would start their visit by boarding a public transit system in the nearby community of Tusayan and arrive at the Mather Point orientation center.

Analyzed are the impacts of taking no action and three action alternatives. Common to all action alternatives is the development of the Mather Point orientation and transit center. The three action alternatives differ in the number of private automobiles accommodated at the Mather Point facility and the mode of transportation between Tusayan and Mather Point.

NO ACTION

Summary of Actions

No action would mean that the Mather Point orientation and transit center would not be developed; no further park encouragement or cooperation would be provided for the Tusayan transit facility; a public transit system to and from the South Rim would not be realized; and day use parking in Grand Canyon Village would be maintained.

Summary of Impacts

No new biotic impacts would occur. Further degradation of air quality and increase in noise levels would result from increased vehicles on the South Rim. The visitor experience would continue to degrade as vehicle numbers and associated noise from private vehicles would increase.

Five archeological sites originally impacted by the construction of the South Entrance Road could be adversely affected by cars parked illegally along the road shoulders approaching Mather Point. Congestion would continue in the historic district.

There would be little effect on the off-season visitor experience. The summer use visitor experience would continue to deteriorate.

There would be no impact on off-season traffic management. During the summer the village transportation system would continue to be inadequate.

Existing park operation problems, such as providing quality transportation, parking, and orientation and interpretive services in the South Rim, especially for an ever-increasing summer visitor population, would continue.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Summary of Actions

Grand Canyon Village would be permanently closed to private day use vehicles and tour buses. However, visitors who have overnight reservations at the campground and lodges

would be allowed to drive into the South Rim and park at the Maswik Transportation Center where they would be transported to their room by the hotel or shuttled to other destination points on the South Rim. An orientation center and transit hub would be constructed at Mather Point. The center would serve as a day use visitor transportation hub linking public transit services between the South Rim and Tusayan, and as a place for visitors to connect with transit services accessing various South Rim destinations.

Existing South Rim shuttle bus service would be expanded and include routes on West Rim Drive, Yaki Point, and the South Kaibab trailhead. The buses would be liquefied natural gas or battery powered; future conversion to fuel cell is planned. Collectively, about 1 mile of new access road sections would be required so private vehicles would not have to use public transit routes from Mather Point to Grand Canyon Village.

The dry dump site would be used as a transportation vehicle maintenance area.

Summary of Impacts

Approximately 23 acres of *piñon*/juniper habitat would be affected. Approximately 7 acres of disturbed habitat would be restored leaving a net impact of 16 acres. No special status species or critical habitats would be impacted.

As private vehicle traffic is reduced in the South Rim, vehicle emissions affecting air quality over the Grand Canyon would be reduced as would vehicle noise.

Three archeological sites would be destroyed and six additional sites could receive indirect impacts. There would be an overall beneficial effect from reduced vehicular congestion in the historic district.

The short-term visitor experience would be adversely affected by construction activities and traffic for the duration of construction. Over the long term, the function of South Rim roads would be restored to the purpose of providing a safe, leisurely, and enjoyable route for relaxed sightseeing. By receiving orientation and interpretation early in their visit, visitors would be able to tailor their visit to a variety of park opportunities and shuttle routes. Summer visitors would no longer face the confusion, congestion, and frustration of overcrowded roads and parking areas; traffic problems in the South Rim and Grand Canyon Village would be greatly reduced.

In the year 2000 there would be a $.91 transportation cost for each visitor for the shuttle bus service; this fee would drop to $.81 in the year 2010. The transportation cost would be included in the park entrance fee.

Park operations would be greatly helped. The roads would remain serviceable for several decades without major maintenance needs; time spent by park staff conducting road repairs would be reduced. During the summer months, park protection rangers would no longer be required to spend a great deal of their time assisting visitors who are involved in traffic accidents, are lost, park illegally, or seek information.

Annual operation and maintenance cost for the shuttle bus service would total $3.1 million; annual capital cost would total $2.4 million.

ALTERNATIVE TRANSIT SYSTEMS

Three alternative transit systems for moving visitors to and from the Mather Point orientation and transit center are described.

The proposed federal action consists of the elements common to all action alternatives and selection of one of the three transit systems.

Alternative A

Winter use levels of public transit and tour bus and private automobile parking would be provided at Mather Point. Parking for 841 cars and 42 RVs would be provided; parking would be on a first-come, first-served basis. The principal method of access to Mather Point would be via public bus transit service from Tusayan. The public transit buses would run to and from the Mather Point orientation and transit center during the nine-month high visitor use period of March through November; the buses would not run during December, January, and February. During these winter months, it is anticipated that parking spaces at the Mather Point orientation and transit center would meet visitor demand.

Summary of Impacts

Approximately 11 acres of *piñon*/juniper habitat would be impacted by construction of the new parking lot at the Mather Point orientation and transit center.

Impacts on air quality would be reduced by limiting private vehicles in the park; continued private vehicle parking at Mather Point would allow vehicle noise to affect visitors.

Public transportation from the Tusayan Gateway facility would be provided March through November. If the parking lot at Mather Point is full during the summer, visitors would return to Tusayan and ride public transportation to the Mather Point center. In the year 2000 there would be a $1.20 transportation cost for each visitor; this fee would drop to $1.18 in the year 2010. This fee is in addition to the cost per visitor for the shuttle bus service. The transportation cost would be included in the park entrance fee.

Construction of a parking lot at the Mather Point orientation and transit center would have a moderate impact on scenic values, although vegetative screening would be used to soften the appearance of the lot.

Annual operation and maintenance cost for visitor transit system would total $5.3 million; annual capital cost would total $2.8 million.

Alternative B

There would be no private vehicle parking at the Mather Point orientation and transit center. Visitors would park at the Tusayan gateway facility and ride to the Mather Point orientation and transit center on a bus transit system, which would use the South Entrance Road. The public transit bus service would operate year-round between the Tusayan gateway facility and the Mather Point orientation and transit center.

Summary of Impacts

No additional habitat beyond that identified in the "Impacts Common to All Alternatives" section would be affected by implementation of the visitor transit system.

Air quality would be improved by the use of alternative fuel buses and elimination of private vehicles

The use of a public bus system between Tusayan and Mather Point would have minor noise impacts if alternative technologies were used.

There would be no additional impacts on cultural resources beyond those common to all action alternatives.

Visitors may experience some inconvenience waiting for regularly scheduled transportation buses between the Tusayan gateway facility and the Mather Point orientation and transit center. In the year 2000 there would be a $1.86 transportation cost for each visitor; this fee would drop to $1.62 in the year 2010. This fee is in addition to the cost per visitor for the shuttle bus service. The transportation cost would be included in the park entrance fee. Annual operation and maintenance cost for the visitor transit system would total $7.3 million; annual capital cost would total $3.8 million.

Alternative C

Visitor transportation between the Mather Point orientation/transit center and Tusayan gateway facility would be provided by a light rail system on a dedicated transportation route just west of and parallel to Highway 64. Additionally, the light rail system would run from the Mather Point orientation and transit center west through the village (at or near the Grand Canyon depot) with a stop at the Maswik Transportation Center. From there the light rail would turn south and east past the Pinyon Park development, connecting with the dedicated transportation corridor near the intersection of the Center and South Entrance Roads. South Rim shuttle bus service would be provided from West Rim Interchange to Hermit's Rest and from Mather Point to Yaki Point.

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Summary of Impacts

Approximately 33.5 acres of *piñon*/juniper woodland and some Ponderosa pine habitat would be disturbed for construction of a light rail transportation corridor.

Emissions from a light rail system are expected to be minor; therefore, air quality would improve.

Use of a light rail system would further reduce the number of vehicles and noise levels in the park.

The Grand Canyon Village Historic District would be affected by the presence of the light rail; a 9-12 foot section of a historic stone wall in the historic district would be breached; 14 archeological sites could be impacted by the construction of a dedicated transportation corridor from Tusayan to Mather Point; all effects can be mitigated. Visitors may experience some inconvenience waiting for the regularly scheduled light rail. In the year 2000 there would be a $1.85 transportation cost for each visitor; this fee would drop to $1.42 in the year 2010. This fee is in addition to the cost per visitor for the shuttle bus service. The transportation cost would be included in the park entrance fee.

The light rail train and corridor may be perceived as a visual intrusion. For much of its length, however, the corridor would be screened by tall trees and dense forest.

The light rail would require traffic crossings; crossings would be constructed according to all safety codes.

Annual operation and maintenance cost for visitor transit system would total $6.8 million; annual capital cost would total $2.7 million

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INTRODUCTION

PURPOSE OF AND NEED FOR ACTION

The National Park Service proposes to implement a portion of the approved 1995 *Final General Management Plan / Environmental Impact Statement* at Mather Point on the South Rim of Grand Canyon National Park, Coconino County, Arizona (see the Region map). Visitation to and through the park has steadily increased, especially since the early 1950s, and the existing traffic infrastructure has not kept pace with visitor demands. During 1994, about 3.75 million people visited the South Rim of Grand Canyon National Park, and South Rim visitation is expected to reach or exceed 6.3 million people by the year 2010. As a result, vehicle traffic to and within the South Rim is a growing concern. The 1995 *General Management Plan* documents that this will be a significant impact on resources, traffic management, and visitor experience under current operating conditions.

To reduce ongoing and anticipated impacts on resources, facilitate traffic management, and improve the visitor experience to and within the South Rim, the National Park Service proposes to construct the Mather Point orientation/transit center and transit system as approved in the *General Management Plan*. The ultimate goal of this action is to remove day use parking from Grand Canyon Village. The proposed federal action consists of construction of an orientation/transit center near Mather Point and implementation of one of three alternative transit systems. Alternatives include extensive parking at the Mather Point orientation/transit center, a light rail system, and different levels of bus services.

This environmental assessment is being released for public comment without a preferred alternative.

RELATIONSHIP TO PREVIOUS, CURRENT, AND FUTURE PLANNING EFFORTS

General Management Plan

The *Final General Management Plan / Environmental Impact Statement* was released in July 1995, and the record of decision was approved on August 21, 1995. The *General Management Plan* is available at www.nps.gov/grca/gmp/ on the Internet.

The *General Management Plan* sets forth the basic management philosophy for the park; it is a comprehensive tool for future park management and provides the strategies for addressing issues and achieving identified management objectives for a 10- to 15-year period. Two types of strategies are presented in the plan: (1) those required to properly manage the park's resources while providing for a meaningful visitor experience, and (2) those required to encourage compatible activities on adjacent lands so as to minimize adverse effects on the park. Based on these strategies, the plan identified programs, actions, and support facilities necessary for efficient park operation and visitor use.

With regard to the Mather Point orientation/transit center and transit system, the plan called for construction of a facility near Mather Point to function in orienting visitors to sites and experiences on the South Rim. The plan envisioned the Mather Point facility to be linked to a transportation staging area just north of Tusayan (see the Project Location map). According to the plan, most South Rim visitors would start their trip in Tusayan by boarding a private tour bus or a park transit bus and arrive at the Mather Point orientation and transit center. Upon arriving at the center, visitors would

board shuttle buses to reach various destinations on the South Rim.

This environmental assessment tiers from the approved *Final General Management Plan / Environmental Impact Statement*. That final plan is programmatic and conceptual, recognizing that site-specific planning and compliance would be conducted as needed for implementation. This environmental assessment, therefore, assesses the issues and impacts of constructing the Mather Point orientation and transit center and also analyzes three alternatives for transporting visitors to and from the South Rim.

Tusayan Growth Environmental Impact Statement

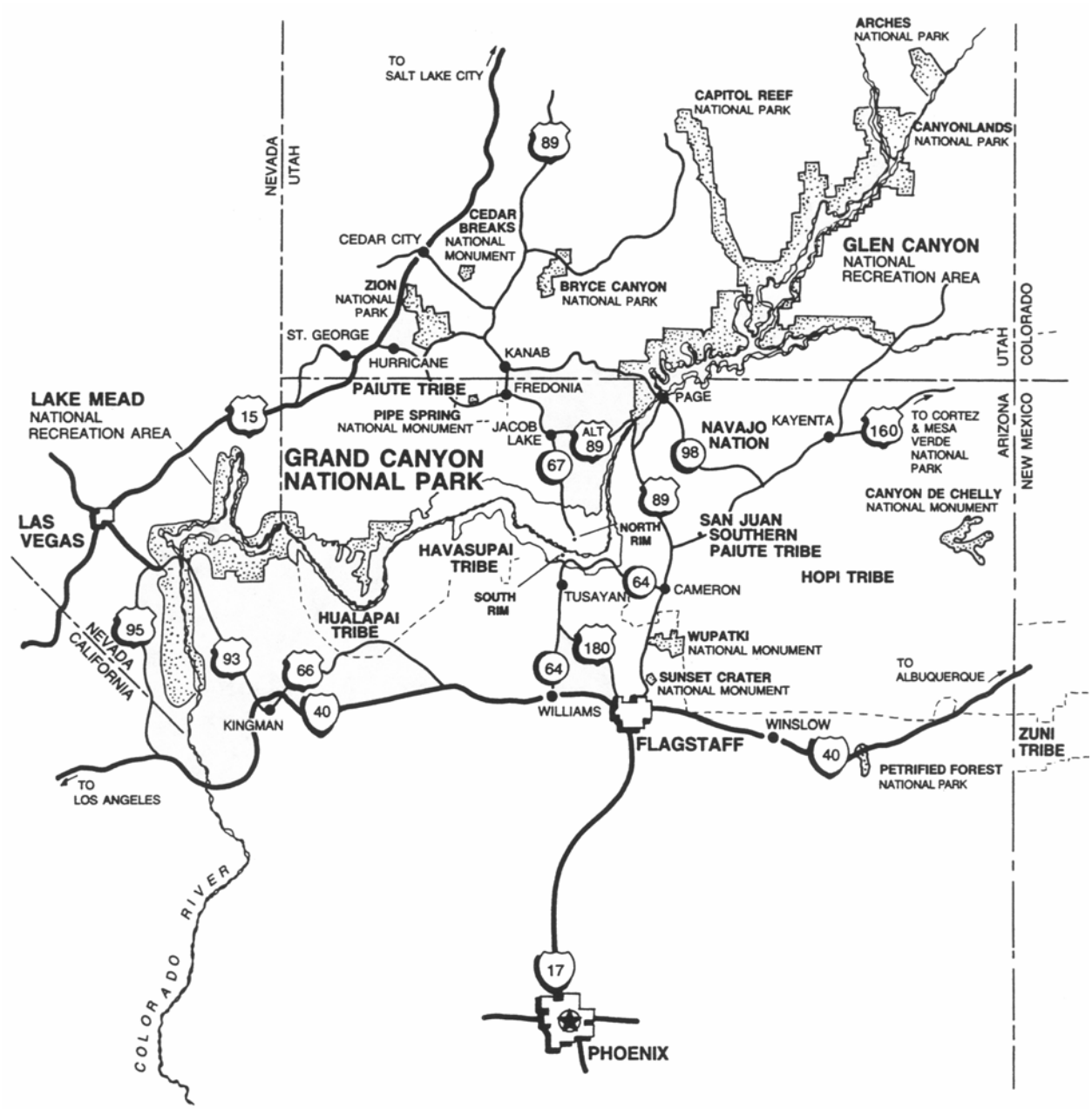
Annual park visitation doubled between 1984 and 1994, creating substantial development pressure in the Tusayan area, particularly for commercial facilities. The *General Management Plan* identified a need for cooperation with the community and the U.S. Forest Service to develop a transportation staging area in Tusayan (Tusayan gateway facility) linked with the Mather Point orientation and transit center. The U.S. Forest Service is now leading the preparation of an environmental impact statement, with participation from Grand Canyon National Park, Coconino County, and the Northern Arizona Council of Governments, to address potential land exchanges in and around Tusayan to manage

growth. The U.S. Forest Service will specifically address impacts of the proposed construction of the Tusayan gateway facility. The draft *Tusayan Growth Environmental Impact Statement* is anticipated to be available for public review in May 1997. A record of decision is expected in June 1998.

Northern Arizona Council of Governments Regional Transportation Strategy

The Northern Arizona Council of Governments (NACOG) has undertaken an effort to test the feasibility of establishing regional transportation staging areas in various gateway communities in northern Arizona. Flagstaff, Williams, Cameron, and Valle are the communities being closely considered.

In concept, a transportation staging area would be established in each community, and bus service would be initiated (in the case of Williams, additional rail service could be substituted for buses). The intent would be to keep cars parked in the gateway communities rather than in Tusayan. The NACOG strategy is not a proposal but a conceptual feasibility study for others to expand upon. If communities and bus companies adopt the concept, it could have the effect of reducing the parking demand at the Tusayan staging facility and increasing the number of transit buses dropping passengers at Mather Point. The buses would not park at Mather Point but would provide regularly scheduled service, returning immediately to their point of origin.



REGION

GRAND CANYON NATIONAL PARK • ARIZONA

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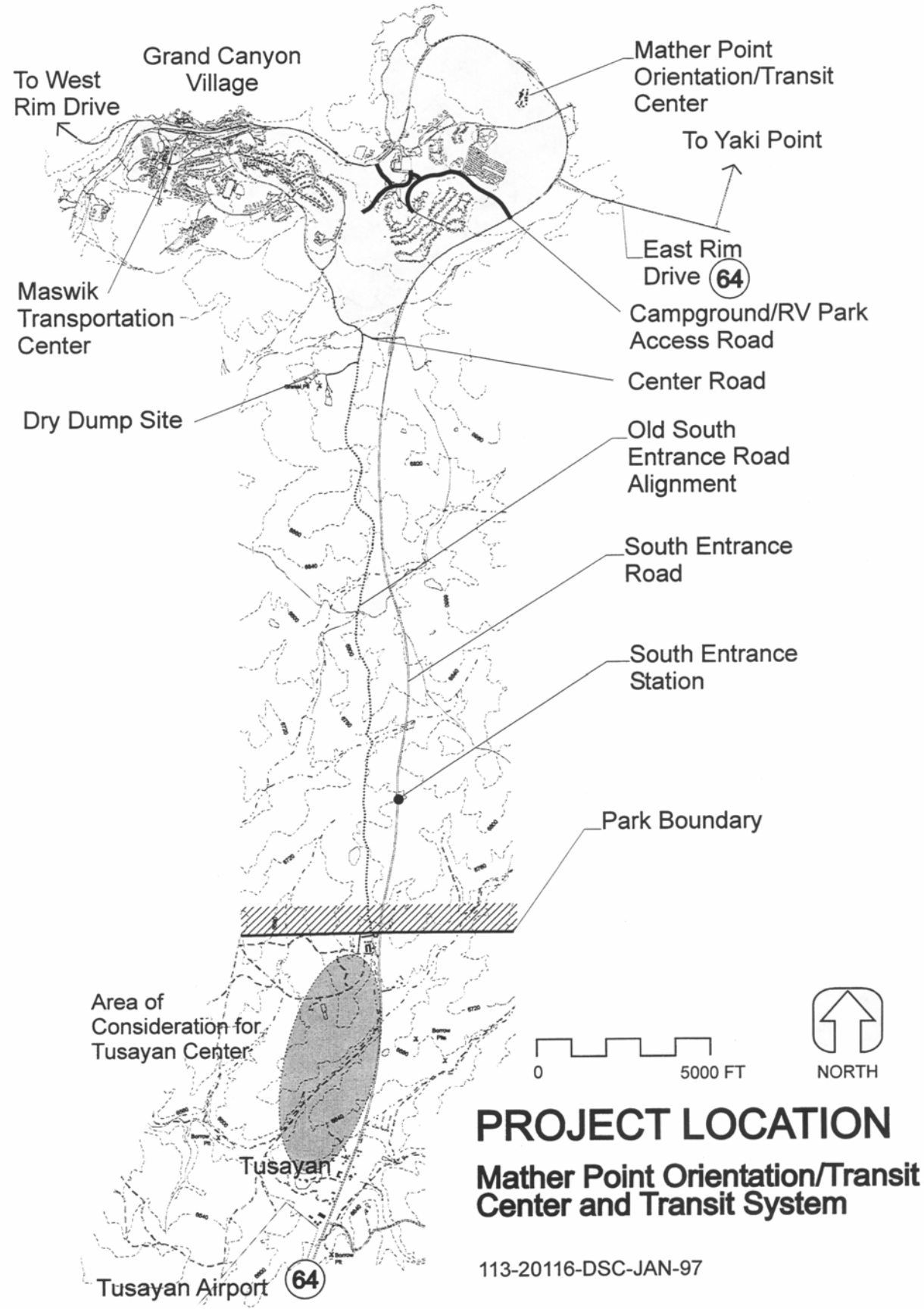


PROJECT LOCATION

Mather Point Orientation/Transit Center and Transit System

113-20116-DSC-JAN-97

Grand Canyon Railway Spur Line

In the late 1980s, the Grand Canyon Railway proposed to construct a spur line from the existing track west of Grand Canyon National Park Airport to the "wedge" of national forest lands created by the airport runway and Highway 64. On that wedge of land, the railway proposed to build a large parking lot and two rail depots (one for air passengers and one for auto passengers) and to establish an hourly shuttle from this site into Grand Canyon National Park. An environmental impact statement was prepared, and a record of decision was signed in August 1993. The decision, which was to approve the proposal, is currently under appeal. However, the Grand Canyon *General Management Plan* has since been adopted (1995), and it states a preference for the Tusayan transportation staging area just north of Tusayan, which is being evaluated in the *Tusayan Growth Environmental Impact Statement*. The railway has put the spur line proposal on hold, pending the outcome of the *Tusayan Growth Environmental Impact Statement* and resolution of the appeal.

ISSUES AND IMPACT TOPICS

Issues

Issues and concerns affecting this plan were identified from past NPS planning efforts; in meetings with park managers, transportation planners, and environmental groups; and from input from other state and federal agencies. The primary issues (problems to be solved) in this planning effort are as follows:

- efficient transportation of visitors to and from the South Rim
- experience of visitors using the transit system and the Mather Point orientation and transit center
- capital and operating costs of the transit system
- effect on resources from constructing the Mather Point orientation/transit center and its associated trails and facilities
- effect on resources from implementing a transit system to and from the Mather Point orientation/transit center and within Grand Canyon Village

Derivation of Impact Topics

Specific impact topics were developed for discussion focus and to allow comparison of the environmental consequences of each alternative. These impact topics were identified based on federal laws, regulations, and orders; *NPS Management Policies*, NPS knowledge of limited or easily impacted resources; and concerns expressed by the public or other agencies during previous planning projects at Grand Canyon National Park. A brief rationale for the selection of each impact topic is given below, as well as the rationale for dismissing specific topics from further consideration.

Impact Topics Addressed

Biotic Communities. The 1969 National Environmental Policy Act (NEPA) is the basic national charter for environmental protection; among other actions it calls for an examination of the impacts on the components of affected ecosystems. The 1988 *NPS Management Policies*, *NPS-77: Natural Resources Management Guideline*, 1985 *Statement for Management* for Grand Canyon National Park, and the 1995 *General Management Plan* for Grand Canyon National park (among other NPS and park policies) provide general direction for the protection of the natural abundance and diversity of all the park's naturally occurring communities. The *piñon*/juniper woodland community would be the most affected. In addition, the piñon/juniper habitat is prone to wildfires, which present hazards to life and

property and also serve as an important component of shaping biotic communities. Therefore, biotic communities is an impact topic addressed in this document.

Air Quality. Grand Canyon National Park is a class 1 air quality area, the cleanest standard. Air quality and related visibility are significant issues at the Grand Canyon. Construction of the Mather Point orientation/transit center and transit system would have short-term impacts on air quality as well as the long-term operation of a transit system; therefore, air quality is an impact topic addressed is this document.

Noise. In 1987 Congress passed the National Parks Overflights Act, which had as a goal "the substantial restoration of natural quiet" at Grand Canyon National Park through active management of aircraft flying in Grand Canyon airspace. In a report to Congress several years later, the National Park Service determined that this goal had not been achieved and that further actions were necessary to "substantially restore natural quiet." The 1995 *General Management Plan* aimed to restore quiet to the rim overlooks through the removal of parking lots and traffic noise adjacent to the overlooks. Noise from the construction of facilities as well as the operation of a transit system is addressed as an impact topic in this environmental assessment.

Cultural Resources. The 1966 National Historic Preservation Act (16 USC 470 et seq.) as amended in 1992, the National Environmental Policy Act, the 1916 NPS Organic Act, 1988 *NPS Management Policies*, NPS-2 (*Planning Process Guideline*), NPS-28 (*Cultural Resource Management Guideline*), and the Native American Graves Protection and Repatriation Act of 1990 require the consideration of impacts on cultural resources. Significant archeological and historic resources and potentially significant ethnographic resources are within the project area. Therefore, cultural resources is an impact topic addressed in this document.

Visitor Experience. The 1916 NPS organic act and the 1988 *NPS Management Policies* state that the National Park Service will promote and regulate the use of parks and provide those services necessary to meet the basic needs of park visitors, provide for public enjoyment, and achieve each park's management objectives. Public enjoyment includes orientation and interpretation. The 1985 *Statement for Management*, the 1994 *Statement for Interpretation*, and the 1995 *General Management Plan* for Grand Canyon National Park support this philosophy. The experience of the visitor coming to and from the South Rim and the cost to the visitor in using the transit system is an impact topic that is addressed in this document.

Scenic Values. Conserving the scenery of national park units is a fundamental purpose of the 1916 NPS organic act. Providing for visitor enjoyment is one of the elemental purposes of the National Park Service according to the organic act. Various park plans, including the park's 1985 *Statement for Management* and the 1995 *General Management Plan* established provisions for conserving the Grand Canyon scenery. Any construction within the park has the potential to affect the park's scenic values. Therefore, scenic values is an impact topic addressed in this document.

Traffic Management. Heavy summer use and inadequate roads and parking areas on the South Rim have combined to create conditions that adversely affect the visitor experience and that are contrary to the National Park Service's position that park roads are intended to enhance visitor experience while providing safe and efficient accommodation of park visitors. Construction in the short term as well as

operation of the transit system in the long term would affect traffic; therefore, it is an impact topic addressed in this document.

Park Operations. Inadequate transportation, parking, and orientation facilities and services affect day-to-day operations of the park. The operation of the Mather orientation/transit center and a transit system affects staffing and operations; therefore, this is an impact topic addressed in this document.

Impact Topics Dismissed from Further Analysis

Socioeconomic Values (including Local and Regional Economy, and Park Businesses). Impacts on socioeconomic values usually consist of impacts on local and regional businesses and residents, the local and regional economy, and park concessions. The local economy and most business at Tusayan are visitor-related and have developed as an offshoot of park visitation. The regional economy is more diverse, but strongly influenced by visitor activity. Concession operations at the village include lodging, dining, supplies, and shops and are predominantly visitor related. The 1995 *Draft General Management Plan / Environmental Impact Statement* discussed the socioeconomic environment and impacts extensively; this discussion is summarized below.

Should any of the action alternatives be implemented, there would be short-term economic benefits from construction-related expenditures and employment. In the long term, park visitors would be staged at the Tusayan facility to board the transit system. Visitors would purchase goods and services in Tusayan.

Most businesses within the park would not experience any short-or long-term economic impacts. Short-term impacts could be related to traffic flow during construction. The South Entrance Road could be periodically closed for construction purposes. However, the use of Center Road as an alternate route for some periods would equalize traffic flow. Traffic flow would be maintained subject to a schedule that would allow construction to proceed.

Although the action alternatives call for closing Grand Canyon Village to private vehicles and tour buses, visitors would ride the transit system to and within the village. Lodging accommodations, restaurants, stores, and other facilities would still provide goods and services; closing the village to private vehicles and tour buses is not anticipated to change visitor spending patterns or affect the amount of visitor spending in the long term. Transportation costs to riders is evaluated under visitor experience.

There would be short- and long-term benefits to the Tusayan economy, park businesses would not be appreciably affected during construction.

Special Status Species (Threatened, Endangered, Candidate, and Rare Species). The 1973 Endangered Species Act, as amended, requires an examination of impacts on all federally listed threatened and endangered species. NPS policy requires examination of the impacts on state-listed threatened or endangered species and federal candidate species. In a letter dated October 8, 1996, the U.S. Fish and Wildlife Service lists a number of special status species on the federal list that have potential to reside in the project area or depend on it for critical habitat. In a letter April 29, 1996, the Arizona Game and Fish Department provided a statewide list of Arizona special status species and critical habitats (see appendix A for copies of federal and state special status species lists).

According to park records and field surveys of the project site conducted from 1990 to 1996, no threatened, endangered, or special status wildlife species on federal or state lists reside in the area of proposed development or depend on it for critical habitat. Although the federally endangered peregrine falcon (*Falco peregrinus anatum*) is occasionally seen flying over the project area vicinity and nesting sites are known to be away from the project site, the project area is subject to considerable human use and is of little habitat value to the falcons.

No threatened or endangered plants on federal or state lists occur in the project area (Mather Point center and Tusayan gateway facility corridor, Mather Point, and village loop). A population of about 30 individuals of the Tusayan flame flower (*Talinum validulum*), a species of concern in Arizona and listed as a salvage restricted species by the Arizona Native Plant Law, inhabits an open area near Mather Point. The aboveground parts of the Tusayan flame flower grow and flower in response to summer rains. Grand Canyon National Park received average or slightly above normal rain during the summer of 1995. Measures have been prescribed to avoid impact on this species (see the "Mitigation Measures" section of this environmental assessment).

No special status species or critical habitats would be affected by implementing any of the alternatives; therefore, this topic is not analyzed further in this document.

Fire Management. Wildfires in the park are managed under the park's *Fire Management Plan*, which is reviewed and amended as needed each year. The developed areas of the park and adjacent forested rim areas are generally managed under a policy of full wildfire suppression. Prescribed burning and mechanical means are used in these areas to reduce hazard fuels and to reduce the risk of catastrophic wildfire.

Undeveloped park areas are managed under a policy of prescribed natural fire, where naturally occurring fires are monitored but allowed to burn if conditions are within prescribed limits; otherwise, they are fully suppressed.

All the alternatives considered in this document are consistent with the *Fire Management Plan*, so no changes or impacts are anticipated.

Floodplains and Wetlands. Executive Orders 11988 and 11990 require an examination of impacts on and protection of floodplains and wetlands in the placement of facilities. The National Park Service's *Management Policies* (1988), *NPS-2: Planning Process Guideline*, *NPS-12: NEPA Compliance Guidelines*, and the *Master Plan* (1976) and *General Management Plan* (1995) for Grand Canyon National Park provide direction on developments proposed in floodplains and wetlands. The project site was surveyed for floodplains and wetlands. There are no floodplains or jurisdictional wetlands within the project area. Drainage basin sizes are unknown. The 10-year storm flow likely does not exceed 15 cubic feet per second (cfs) and the five-year flow likely does not exceed 13 cfs. These figures are based on similar size washes on the South Rim. The washes are ephemeral and flow only during heavy rains. There are several unnamed washes that may require minor recontouring and/or culverts as part of the project design.

Before construction, the project area would be surveyed for drainages and potential washes that would need to be crossed. The U.S. Army Corps of Engineers would be consulted, and necessary permits would be secured by the park or contractor (see the

"Compliance" section). This topic is not discussed further in this document.

Storm Water Rule. The Storm Water Rule (40 CFR, parts 122, 123, and 124) requires a national pollutant discharge elimination system (NPDES) notice of intent be submitted to the Environmental Protection Agency, with a copy sent to the appropriate State Department of Environmental Quality), on construction activities in excess of 5 acres, e.g., clearing and grading, which may affect storm water discharge. Additionally, the NPDES process requires a storm water pollution prevention plan (SWPPP) be developed before any ground disturbing activities that affect an area greater than 5 acres.

Should any of the action alternatives be implemented, developments would occupy a minimum of 23 acres (alternative B), which would require a storm water pollution prevention plan. Mitigation measures and necessary permits are described in the "Mitigation Measures" and "Compliance" sections of this environmental assessment. Impacts from storm water on water quality is not discussed further in this document.

Executive Order 12898 ("Environmental Justice"). Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The actions proposed in this environmental assessment are not expected to result in significant changes in the socioeconomic environment of the project area, and therefore are expected to have no direct or indirect impacts on minority or low-income populations or communities. This topic is not discussed further in this document

THE ALTERNATIVES

INTRODUCTION

The approved 1995 *General Management Plan* called for an orientation center and transit staging area at Mather Point. Based on an extensive transportation and visitor services analysis, the 1995 plan identified the need for the Mather Point orientation and transit center to accommodate parking for 1,225 private automobiles and 60 tour buses. Most visitors to the South Rim would park at the Tusayan gateway facility (see the "Relationship to Previous, Current, and Future Planning Efforts" section) and board a transit bus, arriving at the Mather Point orientation and transit center. Since the approval of the 1995 plan, further analysis has revealed that providing less private automobile parking and additional tour bus parking at Mather Point would meet the park's objectives for more efficient transportation management. In addition, further study of the mode of transportation from the Tusayan gateway facility to the Mather Point orientation and transit center could be served by buses or by a light rail system.

This environmental assessment analyzes the impacts of taking no action and three action alternatives. Common to all action alternatives is the development of the Mather Point orientation and transit center. The three action alternatives differ in the number of private automobiles accommodated at the Mather Point facility and the mode of transportation between Tusayan and Mather Point.

NO ACTION

As required by the National Environmental Policy Act and NPS policy, an analysis of no action is included for comparison purposes in this assessment. The 1995 approved *General Management Plan / Environmental Impact Statement* provides a complete analysis of no action. This assessment provides a brief synopsis of that analysis to allow for comparison of the action alternatives. No action would mean that the Mather Point orientation and transit center would not be developed; no further park encouragement or cooperation would be provided for the Tusayan transit facility; a public transportation system to and from the South Rim would not be realized; and day use parking in Grand Canyon Village would be maintained.

ASSUMPTIONS USED IN DEVELOPING ACTION ALTERNATIVES

All action alternatives were developed to implement the approved 1995 *General Management Plan*. The management objectives in taking this action are as follows:

- Resolve visitor needs for safe, efficient, and convenient transportation to and from the South Rim.
- Provide orientation and access to a range of visitor experiences on and from the South Rim.
- Reduce resource conflicts and minimize impacts from project implementation.

The major assumptions used in developing the range of alternatives are as follows:

- Certain project elements and impacts are common to all action alternatives and are described in separate sections of this environmental assessment to help facilitate the reader's understanding of the proposal.

- All action alternatives are presented with comparative data (e.g., number of employees needed, size of transit system, cost to visitors). As further design proceeds, the numbers may vary slightly at the time of implementation.
- The alternatives were developed with the assumption that the U.S. Forest Service related action of constructing the Tusayan gateway facility would be accomplished and the facility would be compatible with the Mather Point orientation and transit center. The Tusayan facility and other issues are being evaluated by the U.S. Forest Service in an environmental impact statement. Compatibility of the Tusayan facility would consist of physical location of the Tusayan gateway facility, adequate bus and visitor parking, and orientation and information services.
- The transit system was analyzed based on 1994 visitor study figures and projections of expected visitation in the year 2010. The 10th highest visitation day of the year was used for the summer design day. The highest day did not appear to be a reasonable design value because it represents a very pronounced visitation peak. The 10th highest day was considered to be a more reasonable value for design purposes. Similarly, the 10th highest visitation day of the three winter months (December, January, and February) was used as the winter design day. The summer design day in 2010 would be about 45,000 visitors, and the winter design day would be about 15,400 visitors. Facilities described in the action alternatives are based on the 2010 summer and winter design days.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

This section provides a description of all common elements that would be implemented under any one of the three public transit alternatives. These elements are summarized in Table 1.

TABLE 1: SUMMARY OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

ELEMENT	DESIGN FEATURE
Mather Point orientation and transit center	22,280 square feet of combined floor space
Plazas/pedestrian walkways	23,700 to 31,600 square feet
Viewpoint (rim edge)	expand from 500 to 1,100 feet
South Rim shuttle bus service	• service to West Rim Drive and Yaki Point • West Rim: from 265 to 1,000 rides/hour • Yaki Point: from 35 to 75 rides/hour • 45-foot-long electric drive buses • up to 23 shuttle buses needed
Parking area for private tour buses	spaces (9 acres) for 90 buses
Hotel, airport, and other shuttles	provide dropoff point
Transportation system maintenance area	expand existing dry dump site
Internal Roads	about 1 mile of new road segments
Utilities	200,000-gallon reclaimed water tank located east of tank farm
Staging area	contractor camp outside park

Mather Point Orientation and Transit Center

As directed in the 1995 *General Management Plan*, Grand Canyon Village would be permanently closed to private day use vehicles and tour buses. However, visitors who have overnight reservations at the campground and lodges would be allowed to drive into the park. Visitors who have overnight reservations at a village lodge would be directed to drive their private vehicles to the Maswik Transportation Center parking area (see the Project Location map). From there, they would be transported to their room by the hotel or shuttled to other destination points on the South Rim. Staff would park at the old visitor center near the community center, and would take public transit to Mather Point.

A state-of-the-art sustainable orientation center and transit hub is proposed to be constructed at Mather Point and would be the Mather Point orientation and transit center. The center would serve as a day use visitor transportation hub linking public transit services between the South Rim and Tusayan, and as a place for visitors to connect with transit services accessing various South Rim destinations. The primary goal of this facility would be to offer a menu of opportunities and promptly direct people to their destinations.

The center would include services and facilities such as boarding platforms, route signs and information, pedestrian plazas and trails, restrooms, orientation to the educational themes of the park, a bookstore, a bicycle rental shop, concessions for mule and bus tour reservation services, and administrative and storage spaces. To promote sustainability and to help distribute crowds, most orientation exhibits would be located outdoors. There would also be a central kiosk to answer the most frequently asked questions visitors have upon arrival to the canyon.

Buildings would have a combined floor space of about 22,280 square feet. Plazas connecting the orientation and transit facilities would be about 23,700 to 31,600 square feet. (For a complete description, see "Appendix B: Summary of Spaces and Sizes for the Mather Point Orientation and Transit Center.")

Pedestrian Circulation

The parking lot and existing roadway at Mather Point would be landscaped and converted to pedestrian uses. Pathways and plazas would provide circulation for an estimated 1,185 people/hour for the summer design day for the year 2010. These open areas would allow for unrestricted flow and be at a scale consistent within a natural parklike setting. Pedestrian circulation would be self-orienting to accommodate thousands of visitors at the facility. It would also allow space for large tour groups to maintain contact with each other. Directional signs would be multilingual.

The use of native vegetation in landscaping within the plazas and pathways would reflect the natural environment. Site equipment would include but not be limited to seating, shelter from sun and rain, trash and recycle containers, information kiosks, and lighting.. The plaza would be accessible to all visitors and accommodate and take advantage of grade changes. The walking surface could incorporate patterning to break up monotony and act as a directional aid.

The walkway corridor to/from the canyon rim would consist of multiple paths with rest areas to reduce pedestrian conflicts; relatively narrow multiple paths would be more in keeping with a parklike setting than a very wide single path. Separate paths

would be provided for pedestrians and bicycles to reduce conflicts.

The existing pedestrian and scenic viewing area at Mather Point overlook would be expanded from about 500 feet along the rim edge to about 1,100 feet. Existing signs and interpretation would be reevaluated for continuity and coordination with similar facilities at the Mather Point center. New paths would also tie to existing rim trails connecting back to the village. Paths, railings, and steps would be evaluated for and incorporate handicap accessibility needs.

South Rim Shuttle Buses

Existing South Rim shuttle bus service would be expanded (see the Project Location map). Routes on West Rim Drive and to Yaki Point and the South Kaibab trailhead would be provided. The electric drive buses would be 45 feet long. Up to 23 buses would be required; they would provide about 318 rides per hour in the winter season and about 1,000 rides per hour in the summer to West Rim Drive (see table 1). The buses would be liquefied natural gas or battery powered; future conversion to fuel cell is planned. Using the ratio of 2.5 employees per active bus in the fleet, an additional 51 employees would be required for peak season operation in the year 2010. For shoulder and winter season operation, 36 and 18 employees would be needed, respectively, in 2010. For the year 2000, the figures would be 41 summer, 31 shoulder, and 16 winter. In 2000, costs per visitor would be $0.91; in 2010, this cost would drop to $0.81. The shuttle bus transportation cost would be included in the park entrance fee. See appendix C for an explanation of how costs were derived, as well as a detailed description of ridership projections, transit vehicle requirements, fleet requirements, transit service requirements (schedules), personnel requirements, capital cost estimate, operation and maintenance costs, and cost per visitor.

Tour Buses and Hotel, Airport, and Other Shuttles

There would be a peak demand of 90 tour buses at the Mather Point orientation and transit center. Buses that are not part of the shuttle bus system would not be permitted access west of the Mather Point center.

About 1,643 visitors per hour would be arriving at the Mather Point center by tour buses, and hotel, airport, and other privately run shuttle systems.

Transportation System Maintenance Area

The maintenance area for buses transporting visitors between the Mather Point Center and the Tusayan Gateway facility and the shuttle bus system on the South Rim would be inside the South Rim of the park at the area currently known as the dry dump site near the junction of Center and South Entrance Roads (see the Project Location map). Access to the Dry Dump Site is from Center Road. Maintenance facilities would include garages and administrative offices. Existing facilities at the dry dump site would be adaptively used or removed.

Internal Roads

Collectively, about 1 mile of new access road sections would be required so private vehicles would not have to use public transit routes from Mather Point to Grand Canyon Village. These new road sections would be as follows (also see the Project Location map):

- 0.4-mile access road to link the recreational vehicle (RV) park, the

campground, and the South Entrance Road
- 0.25-mile section of road away from the rim to provide access to the Mather Point center (the existing road section near the rim would be converted to a bike path)
- 0.4-mile link connecting park residences to the business center in Grand Canyon Village

Utilities

A 200,000-gallon reclaimed water tank for nonpotable purposes, such as flushing toilets and landscape irrigation, would be located east of the existing tank farm.

All new utility lines would be buried. All conditioned spaces would be heated and cooled using natural means such as active and passive solar, thermal mass, and wind; these systems would be augmented by conventional mechanical systems.

Staging Areas

Areas for construction truck and equipment staging, storage, and turnarounds would be at previously disturbed areas and areas that are part of the construction zone. All staging areas would be returned to preconstruction conditions once construction was completed. The contractor camp, which would include offices, equipment storage and repair areas, material storage, etc., would be outside the park.

ALTERNATIVE TRANSIT SYSTEMS

Three alternative transit systems for moving visitors to and from the Mather Point orientation and transit center are described. The proposed federal action consists of the elements common to all action alternatives (described above) and selection of one of the three transit systems. This environmental assessment is being released for public review without a preferred alternative.

Alternative A

The Alternative A map illustrates the design elements of this alternative. A recent study of visitor and vehicle projections indicates more tour buses and fewer private vehicles would need to be accommodated at the Mather Point orientation and transit center than described in the 1995 *General Management Plan* (according to information from Peccia Associates 1996; refer to appendix D). Therefore, under this alternative parking capacity would be designed to accommodate 841 automobiles, 42 RVs, and 90 private tour buses. Visitors arriving after the Mather Point parking lot is full would board public transit buses at the Tusayan gateway facility and ride to the Mather Point orientation and transit center (see the "Assumptions Used in Developing Action Alternatives" section).

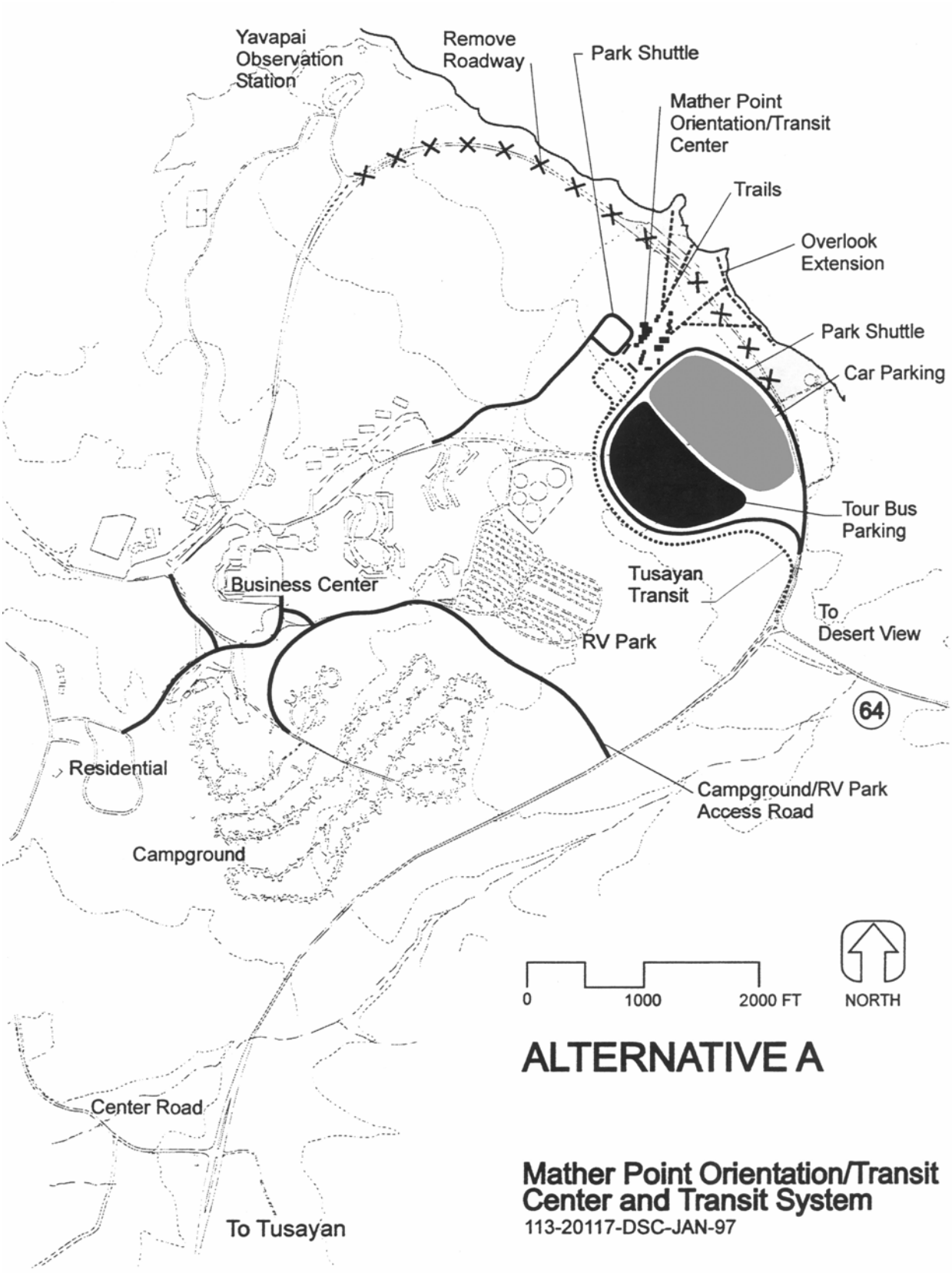
About 1,517 parking spaces for private automobiles, 40 spaces for RVs, and 7 spaces for public transit buses would be needed at the Tusayan gateway facility.

The public transit buses providing transportation between the Tusayan gateway facility and the Mather Point orientation and transit center would be standard-sized transit buses accommodating 80 people per bus. Initially, the buses would be powered with liquefied natural gas (LNG) engines driving electric wheel motors. In the long term, however, the LNG engines would be replaced with fuel cell power or a similarly quiet and clean technology. Fuel cell engines would be powered with natural gas or methanol to create electricity on-board, creating only water as a "waste" product. Minimal noise would be generated from the engines.

Public transit buses, private vehicles, and private tour buses would use the existing Highway 64 and South Entrance Road. Upon arrival at the Mather Point orientation and transit center, visitors would transfer to park shuttles to reach their destination points.

Parking at the new lot would be on a first-come, first-served basis. During the summer season, if parking is at capacity, visitors would be informed in Tusayan and encouraged to park there and ride the public transit system to Mather Point. Public transit buses would run to and from the Mather Point orientation and transit center during the nine-month high visitor use period of March through November; the public transit buses would not run during December, January, and February. During these three winter months, it is anticipated that parking spaces provided at the Mather Point orientation and transit center would meet all visitor demand; hence, parking capacity was established for 841 automobiles under this alternative.

About 1,810 visitors would arrive each hour by public transit buses at Mather during the peak visitation period. In addition, about 1,643 visitors would arrive each hour by way of private tour buses and hotel/airport shuttles during peak periods. Buses would run from the Tusayan gateway facility to the Mather Point orientation and transit center from 6:00 A.M. to 10:00 P.M. during the summer, with buses departing from 2 to 8 minutes apart. By the year 2010, 14 public transit buses would be needed to operate between Mather Point and Tusayan, and 33 shuttle buses would be needed to operate between Mather Point and Grand Canyon Village. About 93 additional staff would be needed to operate the public transit system and shuttle bus service by the year 2010.


Yavapai Observation Station
Remove Roadway
Park Shuttle
Mather Point Orientation/Transit Center
Trails
Overlook Extension
Park Shuttle
Car Parking
Tour Bus Parking
Tusayan Transit
To Desert View
64
Business Center
RV Park
Residential
Campground
Campground/RV Park Access Road
Center Road
To Tusayan
0
1000
2000 FT
NORTH
ALTERNATIVE A
Mather Point Orientation/Transit Center and Transit System
113-20117-DSC-JAN-97

Alternative B

The Alternative B map illustrates the design elements of this alternative. Alternative B calls for no private vehicle parking at the Mather Point orientation and transit center; there would be parking for 90 private tour buses. Visitors would park their vehicles at the Tusayan gateway facility and ride to the Mather Point orientation and transit center on a bus transit system, which would use the South Entrance Road. The public transit bus service would operate year-round between the Tusayan gateway facility and the Mather Point orientation and transit center.

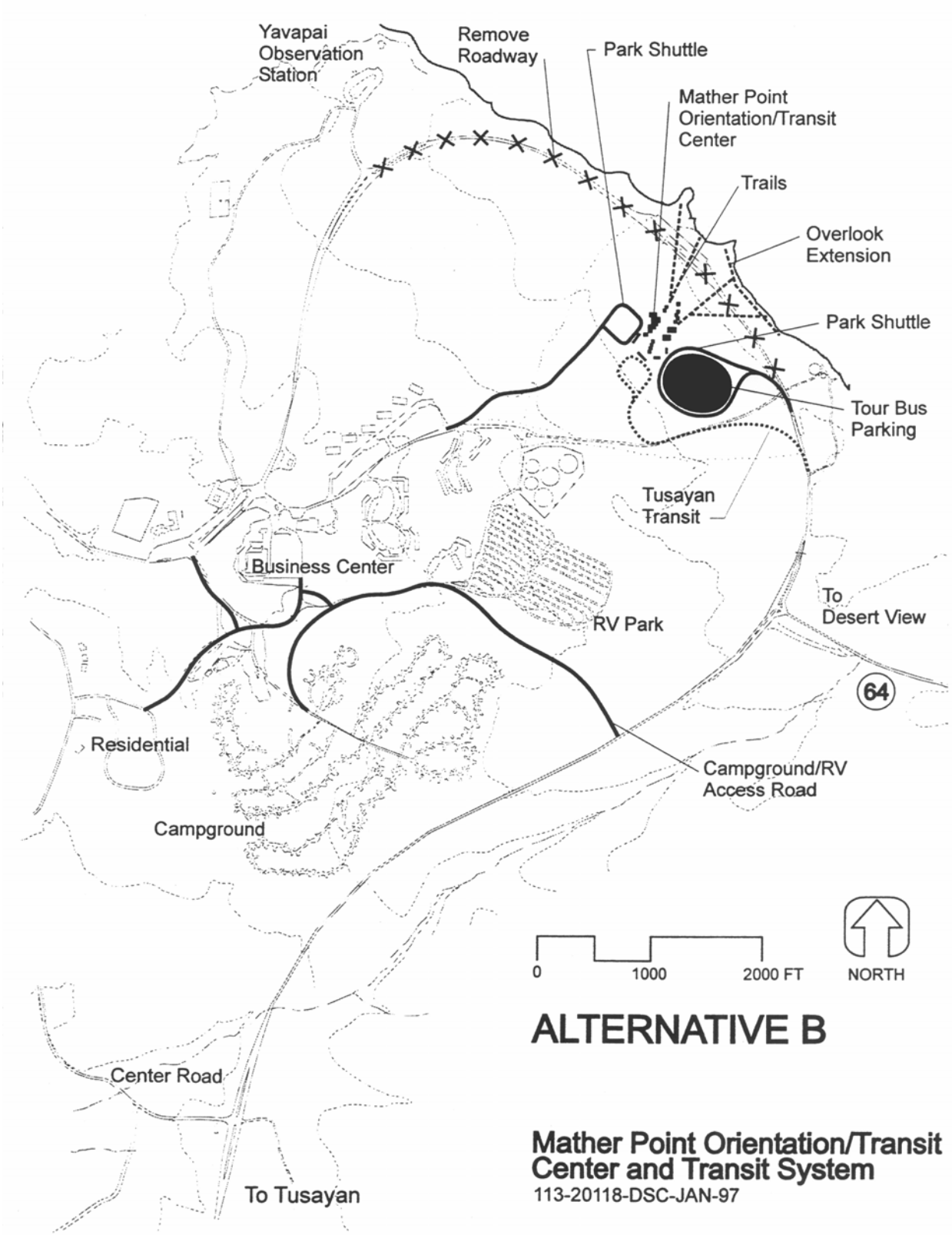
About 2,556 parking spaces for private automobiles, 82 spaces for RVs, and 7 spaces for public transit buses would be needed at the Tusayan gateway facility.

As in alternative A, the public transit buses providing transportation between the Tusayan gateway facility and the Mather Point orientation and transit center would be standard-sized transit buses accommodating 80 people per bus. The buses would be liquefied natural gas or battery powered; future conversion to fuel cell or a similarly quiet and clean technology is planned. Fuel cell engines would be powered with natural gas or methanol to create electricity on-board, creating only water as a "waste" product. Minimal noise would be generated from the engines.

Public transit buses, private vehicles, and private tour buses would use the existing Highway 64 and South Entrance Road. Upon arrival at the Mather Point orientation and transit center, visitors would transfer to park shuttles to reach their destination points.

About 2,800 visitors per hour would arrive at Mather Point via public transit buses during the peak visitation period. In addition, 1,643 would arrive each hour via private tour buses and hotel/airport shuttles during peak periods. Buses would run from the Tusayan gateway facility to the Mather Point orientation and transit center from 6:00 A.M. to 10:00 P.M. during the summer, with buses departing from 2 to 8 minutes apart. By the year 2010, 21 public transit buses would be needed to operate between Mather Point and Tusayan, and 33 shuttle buses would be needed to operate between Mather Point and Grand Canyon Village. About 108 employees would be needed to operate the public transit system and shuttle bus service by the year 2010.

The South Entrance Road from Mather Point to the village loop drive would be restricted to public transit vehicles only. This portion of the South Entrance Road would become a dedicated public transit corridor. Overnight private tour buses dropping passengers off at lodges along the rim would be allowed access to those hotels Limited day and overnight bus parking would be provided at the Maswik Transportation Center.

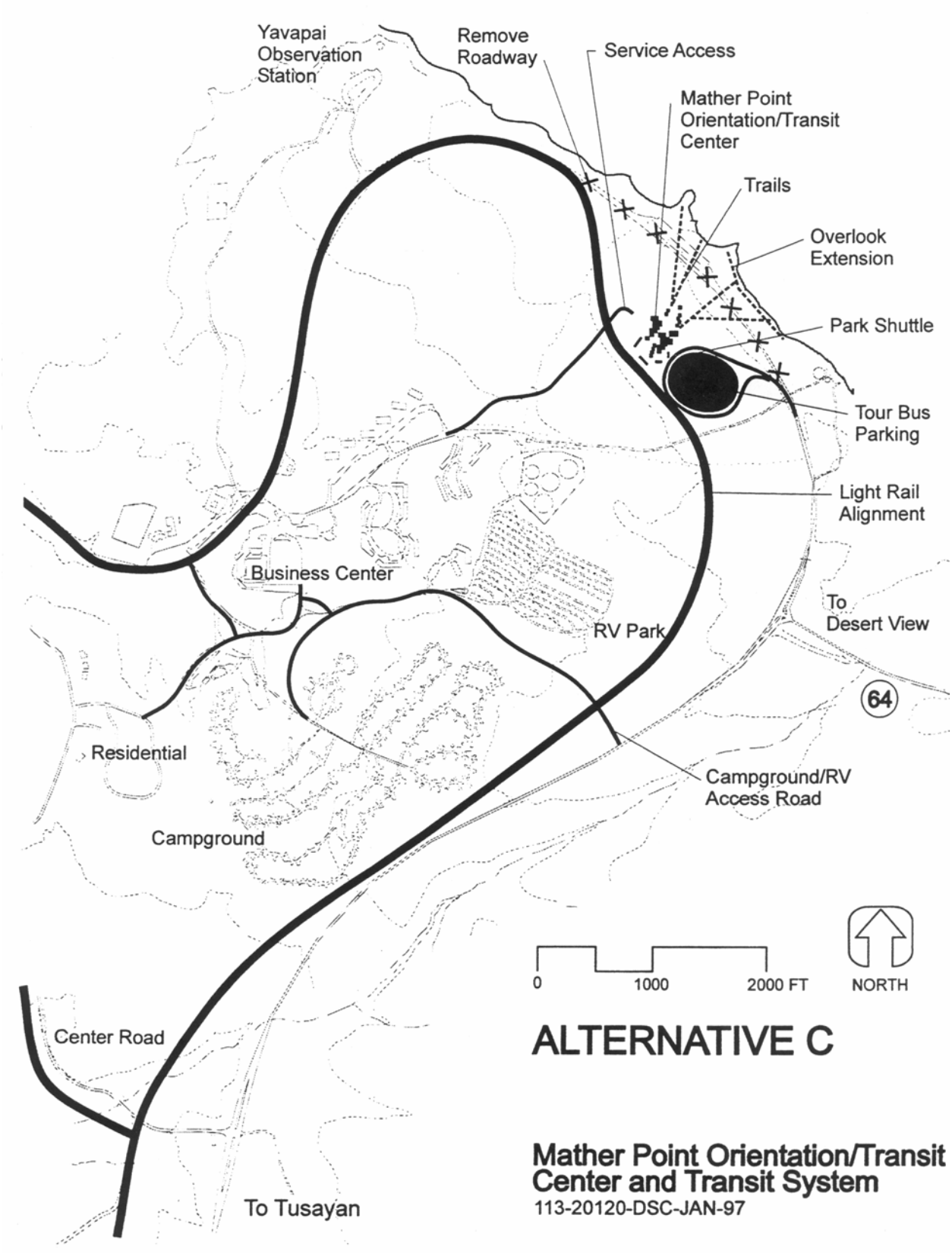

Yavapai Observation Station
Remove Roadway
Park Shuttle
Mather Point Orientation/Transit Center
Trails
Overlook Extension
Park Shuttle
Tour Bus Parking
Tusayan Transit
Business Center
RV Park
To Desert View
64
Residential
Campground/RV Access Road
Campground
0
1000
2000 FT
NORTH
ALTERNATIVE B
Center Road
To Tusayan
Mather Point Orientation/Transit Center and Transit System
113-20118-DSC-JAN-97

Alternative C

The features of this alternative are illustrated on the Alternative C and Alternative C -Light Rail Overview maps. Visitor transportation between the Mather Point orientation/transit center and Tusayan gateway facility would be provided by a light rail system on a dedicated transportation route just west of and parallel to Highway 64. Additionally, the light rail system would run from the Mather Point orientation and transit center west through the village (at or near the Grand Canyon depot) with a stop at the Maswik Transportation Center. From there the light rail would turn south and east past the Pinyon Park development, connecting with the dedicated transportation corridor near the intersection of Center and South Entrance Roads. This route was identified as a vehicle route on pp. 49 and 59 of the 1995 Draft *General Management Plan / Environmental Impact Statement* as a western access route. From the junction of Center and South Entrance Roads, the light rail would either loop up to the Mather Point orientation and transit center or turn south and return to the Tusayan gateway facility. Please see appendix E for a detailed description of the light rail.

The route of the light rail through the Grand Canyon Village Historic District would require removal of a section of a historic stone wall at the east end of the railyards south of the Grand Canyon Railroad depot. About 2,556 parking spaces for private automobiles, 82 spaces for RVs, and 7 spaces for public transit buses would be needed at the Tusayan gateway facility.

About 2,800 visitors per hour would arrive at Mather Point via the light rail transit system during the peak visitation period. In addition, 1,643 would arrive each hour via private tour buses and hotel/airport shuttles during peak periods. By the year 2010, about 10 light rail cars per hour would be needed to operate between the Mather Point orientation/transit center and the Tusayan gateway facility. The light rail service would operate 24 hours per day. Departures would be every 10 minutes in the summer and every 15 minutes in the shoulder and winter seasons between 6:00 A.M. and 12:00 P.m. Service is proposed hourly between 12:00 P.M. and 6:00 A.M. About 26 employees would be needed to operate the light rail system by the year 2010.


Yavapai Observation Station
Remove Roadway
Service Access
Mather Point Orientation/Transit Center
Trails
Overlook Extension
Park Shuttle
Tour Bus Parking
Light Rail Alignment
Business Center
RV Park
To Desert View
64
Residential
Campground/RV Access Road
Campground
0
1000
2000 FT
NORTH
Center Road
To Tusayan
ALTERNATIVE C
Mather Point Orientation/Transit Center and Transit System
113-20120-DSC-JAN-97

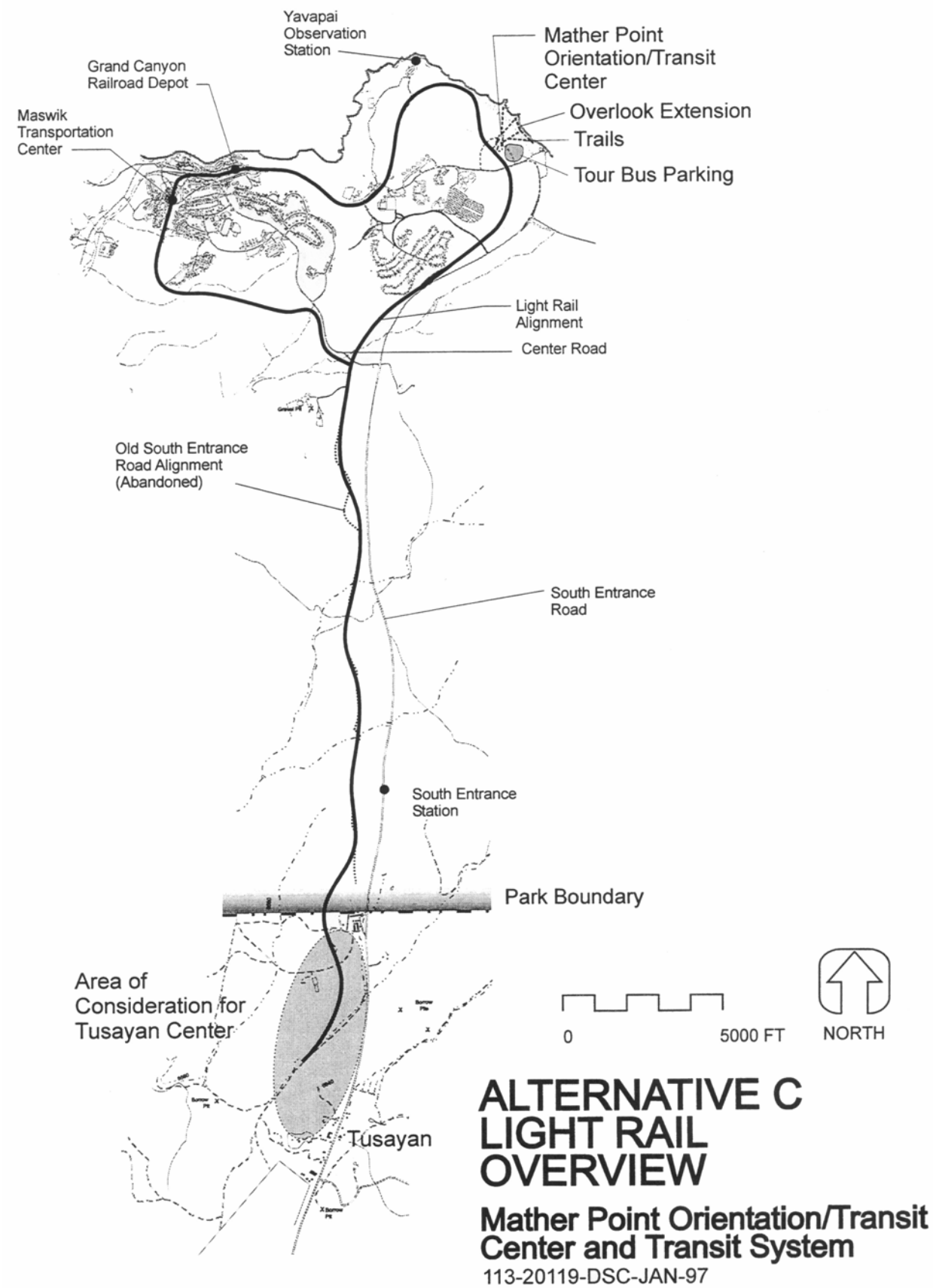

Yavapai Observation Station
Mather Point Orientation/Transit Center
Grand Canyon Railroad Depot
Overlook Extension
Maswik Transportation Center
Trails
Tour Bus Parking
Light Rail Alignment
Center Road
Old South Entrance Road Alignment (Abandoned)
South Entrance Road
South Entrance Station
Park Boundary
Area of Consideration for Tusayan Center
0
5000 FT
NORTH
Tusayan
ALTERNATIVE C
LIGHT RAIL
OVERVIEW
Mather Point Orientation/Transit Center and Transit System
113-20119-DSC-JAN-97

TABLE 2: COMPARISON BY ALTERNATIVE OF VISITORS ARRIVING PER HOUR BY TRANSIT SYSTEM, PRIVATE TOUR BUSES, AND HOTEL SHUTTLES AND NUMBER OF TRANSIT VEHICLES NEEDED BY YEAR 2010

ELEMENT	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Peak number of visitors arriving per hour - Tusayan to Mather Point	1,810	2,800	2,800
Number of visitors arriving by private tour buses and hotel shuttles	1,643	1,643	1,643
Number of public transit vehicles and village shuttles	47 buses	54 buses	10 light rail vehicles

TABLE 3: COMPARISON BY ALTERNATIVE OF ADDITIONAL EMPLOYEES NEEDED TO OPERATE PARK SHUTTLES AND TRANSIT SYSTEMS

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES		ALTERNATIVE A		ALTERNATIVE B		ALTERNATIVE C	
Year 2000		Year 2000		Year 2000		Year 2000	
Summer	41	Summer	76	Summer	91	Summer	26
Shoulder	31	Shoulder	48	Shoulder	66	Shoulder	20
Winter	16	Winter	19	Winter	29	Winter	20
Year 2010		Year 2010		Year 2010		Year 2010	
Summer	51	Summer	93	Summer	108	Summer	26
Shoulder	36	Shoulder	60	Shoulder	78	Shoulder	20
Winter	18	Winter	23	Winter	36	Winter	20

TABLE 4: COMPARISON BY ALTERNATIVE OF COSTS FOR SHUTTLE BUS AND TRANSIT SYSTEM

ELEMENT	SHUTTLE BUS SERVICE COMMON TO ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Mather Point orientation/ transit center (buildings, utilities, roads, parking, and trails)	$26-29 million	$24-27 million	$24-27 million	
Annual operation and maintenance cost	$3.1 million	$5.3 million	$7.3 million	$6.8 million
Annual capital cost	$2.4 million	$2.8 million	$3.8 million	$2.7 million
Cost per visitor - year 2000	$.91	$1.20	$1.86	$1.85
Cost per visitor - year 2010	$.81	$1.18	$1.62	$1.42
NOTE: These figures do not include any development at the Tusayan gateway facility. Capital costs include rolling stock, maintenance/administrative offices and buildings, road rehabilitation, fuel cell conversion, operating costs, etc. Not included in capital costs are taxes, depreciation, housing costs, etc. Cost per visitor would be included in the park entrance fee.				

MITIGATION MEASURES

The following discussion details mitigation measures that have been analyzed as part of the action alternatives. Compliance requirements (permits and other regulatory requirements) are listed in the "Compliance" section of this environmental assessment.

Biotic Communities

No known caves would be affected during project work. However, should construction activities reveal or open any caves, work would be halted in the discovery area and, in consultation with park staff, the opening would be evaluated according to the 1988 Federal Caves Protection Act.

Erosion control measures specified in the park-approved stormwater pollution prevention plan would be implemented to minimize impacts on water quality (see the "Compliance" section). In an effort to avoid introduction of exotic plant species, no imported top soil or hay bales would be used. On a case-by-case basis, the following materials may be used for any erosion control dams that may be necessary: rice straw, straws determined by the National Park Service to be weed free (e.g., Coors barley straw or Arizona winter wheat straw), cereal grain straw that has been fumigated to kill weed seed, and wood excelsior bales.

Silt fencing or filter fabric would be installed along the perimeter of the construction zone. The fabric would be inspected weekly or after every major storm. Accumulated sediments would be removed when the fabric is estimated to be about 75% full. Silt removal would be accomplished in such a way as to avoid introduction into any flowing water bodies. Additionally, sediment traps, erosion checks, and/or filters would be constructed preceding or following all culvert drains (if such drains are required) and in all other ditches before the water (runoff) leaves the project construction limits.

To avoid impacts on the Tusayan flame flower habitat area and the plants themselves, protection measures would include installing snow fencing or construction fencing around the boundaries of the habitat area. Such measures would isolate the habitat area, define the construction zone, and confine construction activity outside the habitat area. Such protection measures would be clearly stated in construction specifications, and the contractor would be instructed to avoid the habitat area. After construction, the habitat site could be incorporated into an interpretive program and may require fencing to protect the plants from trampling.

Revegetation would proceed according to guidelines established by the park staff and *NPS Management Policies*. To protect the genetic integrity of the local flora, the project site, including the construction zone, would be salvaged for plants or seeds. The plants and seeds would be stockpiled and, once the construction project is completed, used to landscape the project site and revegetate the construction zone; any surplus plants or seeds would be used in other park reclamation projects occupying suitable habitats.

Exotic plants might tend to colonize the project site quickly. To reduce this invasive process, revegetation would proceed as soon as possible to decrease the time available for colonization by exotic plants. To control possible introduction of exotic plants, sterile soil or soils from the parent area would be used as fill. The overall goal would be to avoid interfering with natural ecosystem processes and plant communities. Adequate irrigation water resources are available for the revegetative process, which is expected

to last one or two years.

Vegetation impacts and potential compaction and erosion of bare soils would also be minimized by proper stockpiling and replacing topsoil, scarification, mulching, and seeding and/or planting with species native to the immediate area.

If blasting would be required to remove rock, such blasting would take place with park-approved controlled blasting procedures and would conform with the 1991 NPS-65 (*Explosives Use and Blasting Program Guideline*). Any apparent residual drill hole scars would be revegetated. Traces of drill hole scars would be repaired.

Some petrochemicals from construction equipment could seep into the soil. To minimize the amount of petrochemicals seeping into the soil from construction equipment, the equipment would be checked frequently to identify and repair any leaks.

No oil or other fluid would be drained, spilled, or disposed of in the park, except in facilities specifically approved and designated for such purposes. The applicable fluids include crankcase oil, hydraulic fluid, fuel, and any other fluid used in construction or maintenance by the contractor or subcontractors. If any such fluids are spilled or otherwise reach the ground inside the park, the affected area would be cleaned and the waste would be disposed of outside the park at a facility designed for such purpose; soil or other material would be replaced from a source approved by the park.

All construction materials beyond those generated from the construction activities, such as salvaged fill and topsoil, would be disposed of outside the park by the contractor. Some surplus material may be stored at park-approved locations inside the park for use in future projects. Any waste material would be disposed of outside the park. The batch plants for mixing asphalt, concrete, and cement would also be outside the park.

Frequent use by heavy vehicles might have the potential for road damage. However, enforcement of weight limits and other federal, state, and local regulations and contractual stipulations would minimize the potential for conflicts and/or damage.

Construction workers and supervisors would be informed about the special sensitivity of park values, regulations, and appropriate housekeeping.

Air Quality

There would be temporary increases in air pollution during construction, primarily from operation of the construction equipment, but also from possible queuing of visitor's vehicles stopped temporarily during the construction period. The park would apply appropriate mitigation measures limiting idling of construction vehicles, and water sprinkling would be used to partially mitigate the effects of fugitive dust plumes from construction activity. Signs would also be posted for several miles outside the park alerting visitors of the construction and the possibility of 20- to 30-minute delays and requesting that during any such delay, engines be turned off to eliminate motor vehicle emissions (idling vehicles emit far more air pollutants than moving vehicles).

Cultural Resources

Portions of at least nine archeological sites and a potentially significant portion of a cultural landscape could be affected by construction. Although the archeological sites are significant, impacts would have been mitigated ahead of time and construction activities would not adversely

affect important resources. Archeological and American Indian monitoring would ensure that any previously unknown archeological or ethnographic remains were not destroyed. Consultation is underway with the Arizona state historic preservation officer and applicable Indian tribes to determine appropriate mitigative steps; such steps could include appropriate recording of the sites and the presence of an archeological and Native American monitor during construction. Should unknown resources be uncovered during construction, the National Park Service would consult according to the programmatic agreement on the 1995 *General Management Plan* with the Advisory Council on Historic Preservation and the state historic preservation officer; 36 CFR 800.11; and, as appropriate, the provisions of the Native American Graves Protection and Repatriation Act of 1990.

Portions of a cultural landscape may exist within the project area. This landscape is potentially eligible for listing on the National Register of Historic Places and consists of the overlooks and viewpoints along the East Rim. The defining qualities of the landscape (stone walls that melt into the natural landscape; widespread use of native vegetation; low, field-stone curbing; fieldstone steps; and small, private spaces for contemplation of the canyon views) would be preserved and incorporated (to the extent possible) into any new design at the Mather Point overlook. Concrete and other incompatible design materials would not be used. Incorporating these design elements into the newly expanded overlook at Mather Point would mitigate the impacts created by removing the parking lot and expanding the overlook area beyond what was originally envisioned, creating a dynamic cultural landscape with more integrity than that which existed before.

Any other impacts on cultural resources would be documented before destruction or placement of fill, in consultation with the state historic preservation officer.
All contractors would be informed of the penalties for illegally collecting artifacts or intentionally damaging any archeological or historic property by construction crews. Contractors would also be informed of the correct procedures in case previously unknown resources are uncovered during construction activities.

Scenic Values

The architecture, architectural materials, site, and spatial orientation used to design and construct the Mather Point center would follow the 1994 *Architectural Character Guidelines for Grand Canyon National Park*. The final result would be architecture, appearance, and site planning that would be conducive to an organized, harmonious, and cohesive built environment. Additionally, site restoration (revegetation) and use of existing vegetation as screens and buffers would help to provide a sense of naturalness, minimize visual impacts of the developments, and help structures blend with the natural environment.

Traffic Management

The South Entrance Road could be periodically closed for construction purposes. However, Center Road could be designated as an alternate visitor access route for some periods to equalize traffic flow. Traffic flow would be maintained subject to a schedule that would allow construction to proceed.

It is possible that visitor traffic would be allowed to use the South Entrance Road during construction. If so, traffic control would be necessary to complete most aspects of this project. If the roadway remained open, during construction it could be reduced to one lane and traffic would be subject to

alternating, one-way movement at the construction zone. Flaggers or pilot cars would be used during work hours, and automatic signal light systems would control traffic at night. Delays should average no more than 15-20 minutes; access would be provided immediately to any emergency vehicles.

Due to unforeseen circumstances, it may be necessary to close the road completely for one or more days. The Arizona Department of Transportation would receive notice of the construction and closure scheduling, and the general public would be notified through public media and roadside signs. Construction signs would be installed to reduce traffic hazards due to road work. Construction would not be allowed on weekends or holidays unless approved in advance by the superintendent. During these times the contractor would be responsible for leaving the road surface in a drivable condition. This action would minimize disruption to visitors, campers, and park residents. All construction traffic would be required to use the South Entrance Road to enter and exit the park.

ALTERNATIVES DISMISSED FROM FURTHER STUDY

Allowing private tour and transit buses access west of Mather Point, except for delivery of overnight passengers, was considered and rejected due to (1) the large number of buses that would potentially choose to enter Grand Canyon Village, (2) the lack of adequate parking for the buses, and (3) the resulting confusion and traffic congestion that these buses would create as they unloaded and waited to load passengers.

TABLE 5: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

IMPACT TOPIC	NO ACTION	IMPACTS COMMON TO ALL ACTION ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Biotic Communities	Impacts associated with routine maintenance of existing roads, pullouts, and associated visitor-use facilities would continue. Informal pullouts would continue to grow in size and number. No existing roads would be removed and revegetated, and no new roads or trails would be constructed.	Approximately 23 acres of piñon/juniper habitat would be affected. Approximately 7 acres of disturbed habitat would be restored leaving a net impact of 16 acres. Some habitat fragmentation would occur. Overall populations of affected species would be slightly and temporarily lowered during construction; however, once construction was completed and mitigation measures employed, population levels would be expected to recover to some degree. Additionally, landscaping and currently impacted areas that would be restored to natural conditions would provide new wildlife habitat. Minor short-term impacts on local water quality may occur during construction; however, measures would be taken to minimize impacts.	Minor impacts would result from the removal of 11 acres of piñon/juniper habitat for the construction of a parking lot for 841 cars and 42 RVs at the Mather Point orientation and transit center. Thus, the total amount of habitat that would be affected is 34 acres; of this total, 7 acres would be revegetated.	No additional habitat beyond that which is common to all action alternatives would be affected by implementation of the visitor transit system.	Minor impacts would result of the removal of 33.5 acres of piñon/juniper woodland and some Ponderosa pine habitat for construction of a light rail transportation corridor. Thus, the total amount of habitat that would be affected is 49.5 acres; of this total, 4.5 acres would be revegetated.
Air Quality	Further degradation of air quality would result from increased visitors and use of private vehicles.	Short-term, minor impacts during construction would occur. However, measures would be implemented to reduce impacts of fugitive dust during construction. Reductions in emissions that affect air quality over the Grand Canyon would result from any of the transit alternatives.	Short-term impacts on air quality would result from construction activities related to the new parking lot. Use of alternative fuels for the transit buses would help reduce vehicle emissions.	The use of alternative fuel buses and elimination of private vehicles on the South Rim would have long-term beneficial impacts on air quality.	Implementation of a light rail system would have long-term benefits on air quality. The cleanest affordable fuel would be specified.
Noise	The visitor experience would continue to degrade as vehicle numbers increase with increased visitation.	There would be some reduction in traffic noise from private vehicle traffic.	Short-term noise impacts from construction of the parking lot would occur. Over the long term, the reduction in number of private automobiles would reduce overall noise impacts on visitors.	The use of a public bus system between Tusayan and Mather Point would have long-term beneficial impacts on noise levels.	The long-term impacts on noise levels from implementation of a light rail system would be beneficial due to overall reduction in vehicular traffic.

IMPACT TOPIC	NO ACTION	IMPACTS COMMON TO ALL ACTION ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Cultural Resources	The five archeological sites originally impacted by the construction of the South Entrance Road could be adversely affected by cars parked illegally along the road shoulders approaching Mather Point. Congestion would continue in the historic district.	At least nine archeological sites would be affected. None of these effects is expected to be adverse, and all effects can be mitigated. There would be no adverse effects on the cultural landscape. There would be an overall beneficial effect from reduced vehicular congestion in the historic district. The Mather Point parking lot would be removed and revegetated, but character-defining elements would be retained in the expansion of the viewing area at the overlook.	A total of 9 archeological sites could be affected by construction of the RV and car parking lot. In addition, at least one site could be at least indirectly affected by trail development along the rim. None of these effects is expected to be adverse, and all effects can be mitigated.	There would be no additional impacts beyond those common to all action alternatives.	The Grand Canyon Village Historic District would be affected by the presence of the light rail along the historic railway corridor. A 9-12 foot section of a historic stone wall in the historic district would be breached. A total of 14 archeological sites could be impacted by the construction of dedicated transportation corridor from Tusayan to Mather Point. None of the effects on archeological or ethnographic resources is expected to be adverse, and all effects can be mitigated.

IMPACT TOPIC	NO ACTION	IMPACTS COMMON TO ALL ACTION ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Visitor Experience	There would be little effect on the off-season visitor experience. Summer-use visitor experience would continue to deteriorate.	Over the short term, the visitor experience would be adversely affected by noise, dust, fumes, delays, and construction vehicle traffic for the duration of construction activities. Some visitors would be dissatisfied because they would no longer be allowed to drive their personal vehicle into the South Rim. Over the long term, the function of South Rim roads would be restored to the purpose of providing a safe, leisurely, and enjoyable route for relaxed sightseeing. By receiving orientation and interpretation early in their visit at the Tusayan gateway facility, and more specific information at the Mather Point center, visitors would be able to tailor their visit with their needs by choosing from a variety of transit routes leading to various park destinations. Summer visitors would no longer face the confusion, congestion, and frustration of overcrowded roads and parking areas. In the year 2000, cost per visitor for the shuttle service would be $0.91; in 2010, this cost would drop to $0.81. The transportation cost would be included in the park entrance fee.	Parking for 841 cars and 42 RVs would be provided at the Mather Point orientation and transit center. Transportation from the Tusayan Gateway facility would be provided March through November; space would be provided for camping and other gear. In the year 2000 there would be a $1.20 transportation cost for each visitor; this fee would drop to $1.18 in the year 2010. This fee is in addition to the cost per visitor for shuttle bus service. The transportation cost would be included in the park entrance fee. The overall impacts on the visitor experience would not be appreciable.	Visitors may experience some inconvenience waiting for transportation buses; however, regularly scheduled service every 2 to 8 minutes between the Tusayan gateway facility and the Mather Point orientation/transit center would be provided. In the year 2000 there would be a $1.86 transportation cost for each visitor; this fee would drop to $1.62 in the year 2010. This fee is in addition to the cost per visitor for the shuttle bus service. The transportation cost would be included in the park entrance fee. The overall impacts on the visitor experience would not be appreciable.	Visitors may experience some inconvenience waiting for the light rail; however, trains would depart the Tusayan gateway facility for the Mather Point orientation/transit center every 10 to 15 minutes in peak summer season. In the year 2000 there would be a $1.85 transportation cost for each visitor; this fee would drop to $1.42 in the year 2010. This fee is in addition to the cost per visitor for the shuttle bus service. The transportation cost would be included in the park entrance fee. The overall impacts on the visitor experience would be beneficial.
Scenic Values	There would be no new impacts.	No adverse impacts would be expected, although the Mather Point scenery would be changed. New facilities would blend with and complement existing environments and vistas. Building design and color scheme, plantings around the structures, and spatial orientation would all reduce the visibility and enhance the appearance of the structures. Views of the Grand Canyon would be enhanced over the long term. Views of Mather Point from the North Rim and from within the canyon would not be affected.	Construction of a parking lot at the Mather Point orientation and transit center would have a moderate impact on scenic values, although vegetative screening would be used to soften the appearance of the lot.	Overall impacts on scenic values would be beneficial.	The light rail corridor, and the frequently run light rail itself, up to Mather Point and looping through the village may be perceived as a visual intrusion. For much of its length, however, the corridor would be screened by tall trees and dense forest and impacts on scenic values are expected to be minor.

IMPACT TOPIC	NO ACTION	IMPACTS COMMON TO ALL ACTION ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
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IMPACT TOPIC	NO ACTION	IMPACTS COMMON TO ALL ACTION ALTERNATIVES	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Traffic Management	There would be no impact on off-season traffic management. During the summer, the village transportation system would continue to be inadequate.	Impacts on visitor traffic during construction would be mitigated by those actions previously described in the "Mitigation Measures" section. Over the long term, traffic problems in the South Rim and Grand Canyon Village would be greatly reduced. Since the Grand Canyon village would be closed to day use traffic year-round, the roads would be operating below their capacity, congestion would be abated considerably, and the South Rim road system would be expected to function at level of service (LOS) B or better.	Over the long tern, traffic management would be improved as less vehicles travel to and from Mather Point.	Over the long term, there would be beneficial impacts on traffic management.	The impacts on traffic management would be minor.
Park Operations	Existing park operation problems, e.g., providing quality transportation, parking, and orientation and interpretive services in the South Rim, especially for an ever-increasing summer visitor population, would continue.	Park operations would be greatly helped. The roads would remain serviceable for several decades without major maintenance needs; time spent by park staff conducting road repairs would be reduced. During the summer months, park protection rangers would no longer be required to spend a great deal of their time assisting visitors who become involved in traffic accidents, are lost, parking illegally, or seeking information.	Over the long term, park operations would improve with implementation of a transit system. Limited private automobile parking at Mather Point would require coordination and management to reduce conflicts.	Long-term impacts would be beneficial from elimination of all private automobiles from Mather Point.	Long-term impacts on park operations would be beneficial. The light rail system would provide a single system of traffic movement to and from and within the South Rim.

AFFECTED ENVIRONMENT

The following discussion provides an overview of the resources potentially affected by the project. Some topics (e.g., threatened and endangered species) are not included because they are not present in the project area or the effect of the project on these resources would be negligible (see the "Impact Topics Dismissed from Further Analysis" section of this document). For a complete description of South Rim resources, refer to the 1995 General Management Plan.

EXISTING CONDITIONS - MATHER POINT AND THE GRAND CANYON VILLAGE

The project area slopes gently (5%) southwest from Mather Point toward Grand Canyon Village. The parking lot at Mather Point overlook accommodates 58 cars and 12 buses and occupies slightly more than 1 acre; the South Entrance Road from East Rim Drive to Yavapai Junction occupies 6 acres. Generally, the project area is undeveloped, although lodging, Mather Campground, and water storage facilities are nearby. Utility corridors for two waterlines transect the site. An old roadway connecting Trailer Village to the South Entrance Road also crosses the site.

Electricity is provided to the South Rim by the Arizona Public Service Company. Electric supplies are adequate for all of the proposed new facilities.

The potable water storage facility for the South Rim is about 13 million gallons. As stated in the 1995 management plan, this capacity is expected to meet the present and

predicted future potable and fire suppression water needs of the South Rim. Purification facilities to provide potable water are also adequate for existing and projected needs.

The capacity of the park's wastewater treatment facility is predicted to accommodate all facilities described in the action alternatives.

BIOTIC COMMUNITIES

Soils and Vegetation

Soils in the project area are thin, stony, poorly developed, very low in organic content, and subject to desiccation during the summer.

The principal habitat type of the South Rim is piñon/juniper woodland; overstory vegetation includes piñon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), ponderosa pine (*Pinus ponderosa*), and Gambel oak (*Quercus gambelii*). These species occur in both pure and mixed stands. The height of overstory vegetation varies from about 20-30 feet in many of the piñon, juniper, and oak stands to about 50 feet in the oldest ponderosa pine stands. The canopy is generally closed. Most trees in the village are relatively young. Although all age groups are represented, the average age of the mature piñons and junipers is about 300 years, and the average age of mature ponderosa pines is about 250 years. Thus, the exiting forest established itself during a period of increased moisture in the southwest in the late 1600s and early 1700s.

The Mather Point project area is in piñon/juniper woodland community and big sagebrush association. Areas of deeper soil and higher moisture are vegetated by ponderosa pine. At some point in the distant past, fire swept over a portion of the area creating the mosaic of woodland and open communities found today. The open areas consists of seedling piñon, juniper,

snowberry, and sagebrush interspersed among occasional rock outcrops.

All South Rim facilities have been developed in the major vegetative communities of piñon/juniper, ponderosa, and big sagebrush association. Although about 3 acres of vegetation have been removed for the development of trails, roads and parking areas, buildings, residences, trailer sites, and other facilities, the South Rim area remains densely vegetated by a mature ponderosa forest, a piñon/juniper woodland community, and, towards the east, a big sagebrush association.

Roadside vegetation, especially in the village, is being impacted by visitor use. During peak visitation months, most parking lots are frequently filled to capacity, and it is common for frustrated visitors to pull into any vacant spot large enough to accommodate a vehicle and park anywhere space is available along the roads. Several bare, compacted, informal pullouts have evolved, and with continued use they continue to grow.

Although no unusual plant communities inhabit the Mather Point area, the vegetation is very important for its aesthetic value, which contributes to the natural character of the South Rim as a whole. The vegetation also serves as a natural buffer or screen to visually separate different land uses. Because of the slow growth rates of the native

species, particularly dominant tree species that typically take upward of several hundred years to reach maturity, regrowth of vegetation following disturbance is very slow and requires continuing maintenance until vegetation becomes reestablished.

Wildlife

A variety of transient, seasonal, or permanent birds and small mammals are common along the South Rim and may be found in the project area at one time or another. Commonly seen birds include Steller's jay, piñon jay, raven, violet-green swallow, white-throated swift, hairy and Lewis's woodpecker, rock wren, plain titmouse, several nuthatch species, mountain and western bluebird, mountain chickadee, common bushtit, and black-chinned and broad-tailed hummingbirds. Raptors include red-tailed and sharp-shinned hawks, great horned owl, and occasional peregrine falcon. Small mammals include the Abert squirrel, rock squirrel, golden-mantled ground squirrel, pocket gopher, striped skunk, deer mouse and piñon mouse, and voles. Coyote, gray fox, and bobcat are occasional visitors. Seven species of lizard are found on the South Rim: collared, fence, plateau, whiptail, sagebrush, short-horned, and tree lizard. The only large mammals frequently observed are mule deer, elk, and coyote.

Watercourses

Watercourses of the area generally drain to the south and southwest. Stream flow is more ephemeral than intermittent. Surface flow seldom lasts more than one or two hours after a thunderstorm, and most of the watercourses adequately handle runoff.

AIR QUALITY

Grand Canyon has some of the cleanest air in the contiguous United States, with a visual range that sometimes exceeds 240 miles. The park's class I designation under the federal Clean Air Act carries with it the most stringent standards (or increments) for maximum allowable increases in ambient pollution concentrations over baseline

conditions. Increments for sulfur dioxide, nitrogen dioxide, and total suspended particulates are more stringent in class I areas than in other areas and are quite protective of air quality.

Grand Canyon air quality is influenced by humidity; precipitation, and temperature inversions, as well as long-distance, regional, and local pollution sources.

During the winter, strong cold fronts bring in clean air from sparsely populated areas to the north, and visibility can reach more than 200 miles. However, the air stagnates between cold fronts, and strong temperature inversions form that can trap pollutants below the canyon rim until a new front breaks the inversion and again brings in clean air (USDI 1994).

Sulfates are the major contributors to haze at Grand Canyon. These pollutants travel into the park from distant sources to the south and west and from powerplants to the east and west.

At the local level, air quality is affected primarily by traffic and wood burning appliances. Mobile sources (vehicles, boating, and aircraft) are the predominant emission source categories in the park. Day use visitation represents 80% of the traffic on the South Rim.

NOISE

Noise can be simply defined as any unwanted sound. Impacts such as annoyance from sound sources have been shown to relate to audibility. In very low ambient environments, like those at Grand Canyon, sound sources can be much more audible, thereby having greater impacts, than the same levels from the same sound source in a higher ambient environment.

The park continues to be a focus of attention regarding the effects of aircraft overflights on natural quiet and visitor experience, and methods to mitigate such effects. This issue has nationwide significance for its potential to influence policy regarding overflights of all natural areas. Natural quiet is also adversely affected by other human sound sources in the park, such as cars, buses, trains (including train whistles and bells), and people.

The decibel (dB) is a standard unit of measurement for sound. Each 10 dB increase on the decibel scale represents an increase of 10 times the amount of sound energy, which is perceived by humans as a doubling of the loudness. Because sounds of different frequencies may or may not be perceived as noise, sound measurements are weighted for sensitivity in particular frequencies and are expressed in A-weighted units (dBA).

As a point of reference, a conversation between two people would typically measure about 60 dBA. Sound levels above 80 dBA can cause hearing loss if prolonged.

Typical ambient levels in Grand Canyon Village are in the 50 to 60 dBA range (USFS and NPS et al. 1993). In the park's more arid environments, with less vegetation and human influences to contribute noise, the natural ambient sound levels approach 10 dBA, which is at the threshold of human hearing.

CULTURAL RESOURCES

Archeological Resources

An archeological survey of 279 acres surrounding the proposed Mather Point center revealed the presence of 67 archeological sites dating from possibly as early as 2500 BC to the present. In addition, a survey of portions of the proposed light rail

under alternative C revealed an additional 26 sites. All but one of these sites may be eligible for nomination to the National Register of Historic Places.

Four of the sites dated from the Archaic times (ca. 2500-500 BC). They consist of dispersed surface scatters of stone debitage and bifacial tools without associated features. The dispersed condition of the artifact scatters and lack of associated features suggests a low probability of encountering intact subsurface deposits. The presence of exposed bedrock, abundance of surface lag gravel, and lack of well developed soils suggests that the Archaic ground surface and any associated soils that may have been present in the past have been severely deflated by wind action and eroded by sheet wash erosion over the past two millennium, resulting in wide dispersal of Archaic artifacts across the landscape.

Significantly, about half of the culturally classifiable sites in the larger area surveyed by archeologists reflect habitation and hunting-gathering activities by members of the Cohonina culture (AD 700-1050). Relatively few sites of this time period have

been previously recorded in Grand Canyon National Park, although they are common on the Kaibab National Forest and Havasupai Tribal lands to the south and west of the park (Hanson 1996). In contrast, ancestral Puebloan sites dating between AD 1050-1150 are rare in the project area (n=3), despite the fact that Pueblo II sites are considered to be the most common archeological manifestation in Grand Canyon National Park (Jones and Euler 1979:7). The temporal distribution of Cohonina and ancestral Puebloan sites at Mather Point suggest that this area may have been the eastern frontier of early Cohonina occupation on the South Rim before AD 1000. Later, it may have served as a "cultural frontier" or shared resource procurement zone for the Cohonina and ancestral Puebloan occupants of Grand Canyon between AD 1050 and AD 1200.

The Havasupai and Hopi both claim ancestral ties to the Cohonina. The issue of cultural affinity is complicated by the fact that the name "Cohonina" is actually an anglicized form of the Hopi word for Havasupai people. This term was adopted by archeologists in the 1930s to refer to sites exhibiting a characteristic type of pottery that is the hallmark of this archeological culture. Currently, most archeologists discount the possibility of direct ancestral links between the Cohonina and Havasupai; however, conclusive evidence for or against this proposition is still lacking, in large part because only a few Cohonina sites have been excavated and thoroughly analyzed. Detailed study of the Cohonina sites and associated artifacts in the project area could provide a wealth of information about this still poorly understood prehistoric culture.

Only one site in the Mather Point area can be unequivocally ascribed to the precursors of the historically known Havasupai and Hualapai, a group known archeologically as the Cerbat. The paucity of late prehistoric Havasupai sites in the area is surprising given the numerous historical references placing Havasupai in the general South Rim area from at least the mid-16th century onward. This lack of archeological evidence suggests the possibility that Tizon brown ware ceramics were used and discarded very sporadically, thereby limiting archeologists' ability to recognize these early sites. It is quite possible that some of the unidentified scatters of stone debitage in the project area were left by prehistoric Havasupai people.

Sites indicating historic Havasupai and/or Navajo use of the area are quite common in the survey area. Nine sites include brush shelters, log "corrals," sweathouses, or collapsed wickiups that appear to be from

early 20th century occupations by Havasupais and/or Navajos. Some of the early 20th century artifact scatters could also be from historic Havasupai and/or Navajo use of the area.

All but one of the archeological sites in the area surveyed for this project could be eligible for listing on the National Register of Historic Places for their potential to yield information important to history or prehistory, at least on a local level. Until formal eligibility is determined, all sites are being treated as if they were eligible.

Ethnographic Resources

At least five American Indian tribes may have interest in the area of Mather Point from the standpoint of ethnographic resources. The Hopi and Zuni tribes directly associate themselves with the prehistoric sites of western Puebloan peoples (more

commonly known as the Anasazi). The Navajo and Havasupai claim historic use of the area, and these claims are reinforced by archeological surveys. The Hualapai, being closely related to the Havasupai, may have some historic association with the area as well.

Both the Hopi and Zuni believe that prehistoric western Puebloan archeological sites are a physical record of their migrations throughout the current manifestation of life on Earth and are extremely important in their religious and cultural traditions. They have expressed an interest in NPS treatment of the archeological sites associated with western Puebloan prehistoric use of the area.

Although the Navajo, Hualapai, and Kaibab Paiute tribes have been consulted about potential concerns about development associated with this project, neither have voiced particular concerns beyond being consulted according to the terms of a programmatic agreement between the National Park Service, the Arizona state historic preservation officer, and the Advisory Council on Historic Preservation. The agreement stipulates that each of the tribes will be afforded the opportunity to review project plans during development.

The Havasupai tribe has expressed considerable interest in the project, and regular consultations with the tribe and specific traditional cultural leaders have been undertaken since October 1995. Interviews with tribal elders have indicated that Havasupai people lived throughout the project area within memory of some of the elders, and that specific sites may be associated with specific people or events. At least one site, outside of the area that would be affected in any of the alternatives, may include Havasupai burials. Burials are of considerable cultural importance to the Havasupai, as they are to other tribes.

Cultural Landscape

A cultural landscape is defined as "a geographical area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with an historic event, activity, or person or exhibiting other cultural or aesthetic values" (NPS-28). In the broadest sense, a cultural landscape reflects human adaptation and use of natural resources. This type of landscape is often evident in the division and organization of the land, the presence of both natural and cultural biotic features, the systems of circulation that allow movement, and the types of structures that are built. The character of a cultural landscape is defined by physical material, use and function. Individual features, such as roads, buildings, walls, and vegetation, are material components that, taken together, create the

whole landscape. Patterns of use and function reflect cultural values and traditions.

The Mather Point overlook was built in the 1950s as Grand Canyon National Park began to redirect traffic around Grand Canyon Village to relieve congestion. The physical development of Mather Point reflects both an imitation of certain Civilian Conservation Corps features, such as the rock work, found at other overlooks, especially along the East Rim Drive, as well as the influence of the Mission 66 philosophy in a more utilitarian style of construction. Both CCC and Mission 66 structures and philosophy have received interest by the keeper of the National Register of Historic Places.

The Mather Point overlook was evaluated in the context of a cultural landscape comprised of all of the overlooks and pullouts along the East Rim Drive. Certain design elements found within the overall cultural landscape are present at Mather Point, in particular irregularly built, low stone walls, field-stone steps, field-stone curbing, and the use of benches on the perimeter of the overlook to provide for a semiprivate place from which to view the canyon. The overlook also employs the use of an island of vegetation between the parking lot and the overlook itself, which is a repetitive theme at the other overlooks along the East Rim Drive. Another design element used repeatedly throughout the cultural landscape on the East Rim is the use of a curvilinear safety guardrail to separate visitors from the abyss below. While the design of this railing has changed through time, a deliberate effort has been made to keep the railing as "transparent" and unobtrusive as possible. Mather Point has some of this railing. Other points along the East Rim utilize the same type of railing or low, wide stone walls to provide a barrier. A transparent or otherwise unobtrusive protective barrier at the overlooks is also considered to be a contributing element.

The List of Classified Structures lists one feature, a plaque, at Point Mather. Mather Point itself is not included on the list.

Portions of Grand Canyon Village are listed on the National Register of Historic Places as a historic district. Contributing elements include the 1909 Grand Canyon Depot and accompanying railyard, as well as 237 other structures, stone walls, curbs, roadways, rails, and other landscape features within the village.

VISITOR EXPERIENCE

The U.S. Forest Service and the Williams/Grand Canyon Chamber of Commerce operate a welcome center in the community of Williams. The Flagstaff Chamber of Commerce also operates a welcome center. These centers provide information about Grand Canyon and other attractions in the region and state. No official information about the park is provided at Tusayan or its airport, but general visitor information is provided at the Arizona Tourist Information Host Office at the IMAX Theater.

For many visitors driving personal vehicles, the first park experience is the South Entrance Station. During summer months, long lines of vehicles waiting to pass through the station are frequent. After passing through the station, many visitors find it difficult to become oriented to the South Rim and its road system. Although the South Rim is currently oriented to the automobile, road signs are inadequate, and no orderly progression of experiences or appropriately located visitor orientation facilities help people plan their visit. Tour buses, day use visitors, and overnight visitors are mixed, which adds to traffic congestion.

Some visitor facilities, parking areas, and overlooks are undersized for present needs

and inadequate to accommodate present use levels. Consequently, many visitors spend considerable time simply searching for a parking space; out of frustration, some visitors merely drive off the road or along the road shoulders, park, and walk to their destination.

The village loop shuttle system is used by a little over half of the visitors. To use this system visitors must find a place to park, which in some areas serves to increase the parking problems. The shuttle buses are often filled to capacity and visitors must frequently stand in long lines to board them.

The South Rim visitor center was designed to serve as the primary park visitor contact and interpretive facility. The visitor center is far from the rim and is located past the points where people need information and orientation. The design is outmoded and does not provide for good visitor circulation. Many visitors express disappointment that there is no nearby view of the canyon. Parking is grossly inadequate during the summer season. The main lot fills by early morning and remains filled through late afternoon and vehicles are often found parked along both sides of the entrance road. Part of the problem is that there are too many attractions to hold people's interest and occupy their time. In addition to information and orientation, museums, exhibits, an interpretive film, a book store, and trail access all take visitor's time and lengthen the turnover rate in the parking lot. The information desk is small and although heavily staffed in the summer, it is common for visitors to stand in long lines seeking information about what to do and where to go.

SCENIC VALUES

The Grand Canyon has internationally recognized scenic vistas, qualities, and values. With an ever-changing and colorful scenic grandeur of enormous proportions, it is widely considered one of the world's most beautiful natural areas.

A variety of vista points are provided along the South Rim. As one of the first vista areas visitors encounter as they enter from the south entrance, Mather Point serves as an introduction to the panorama of the Grand Canyon, and is one of the most popular vista areas. With its expansive views across the 18-mile width of this portion of the canyon, it is a renowned area for photographs.

The primary view of the canyon from Mather Point is a panorama from east to northwest. No structures are visible from Mather Point when looking toward the village area. Although two water tanks and the Yavapai lodging units are about 2,000 feet to the southwest, they are not visible because of woodland vegetation. There is a water tank on the rim about 1,500 feet east of the overlook, also screened by woodland vegetation. The park has lighting guidelines, and Coconino County has an ordinance to prevent excessive light pollution at night.

TRAFFIC MANAGEMENT

About 6,000 vehicles enter the park daily through the South Entrance Station during the highest visitor use months of July and August (NPS 1992), with the highest volume occurring between 11:00 A.m. and 3:00 P.m. and again a lower, but significant peak between 5:00 P.M. and 8:00 P.m.. Delays at the South Entrance Station during the midday peaks are usually about 10 minutes and extend 1/2 to 3/4 mile outside the park. In spring 1993, several backups extended 2 miles and resulted in 30-minute delays. These delays are the result of limited staff and high visitation during spring breaks and the Easter holiday. Visitor traffic is subject to

similar delays throughout the summer months.

Peak daily traffic for the South Entrance Road is about 5,600 vehicles, the peak hourly volume is about 550 vehicles. About 2% (110) of all traffic are tour buses; about 11 tour buses enter the park during the peak hour. There is no data available that distinguishes between other types of vehicles such as motor homes, RVs, vehicles towing trailers or other vehicles, or service vehicles.

Center Road passes through the residential area of the village and is primarily an administrative use road, although it carries carry some visitor traffic. The road also carries some bus and truck traffic.

Visitors drive personal vehicles or use the South Rim shuttle bus system to circulate within and between most areas on the South Rim. West Rim Drive is restricted to bus traffic during the summer season. Most roadways are two way, the exceptions being the north side of the village loop and the west side of the village loop between West Rim Drive intersection and parking for the Maswik Lodge.

During spring, summer, and fall, visitors frequently encounter long lines of vehicles waiting to enter the South Entrance. Within the South Rim, congested roads and inadequate parking frequently frustrate visitors.

PARK OPERATIONS

The superintendent for Grand Canyon National Park is responsible for the full scope of managing the park, its staff and residents, all of its programs, and its relations with persons, agencies, and organizations interested in the park. At the direction of the superintendent, the park's management team makes decisions about short- and long-term planning, and provides leadership for all park programs (NPS as well as concessions) and regional programs affecting or affected by the park. Park management sets the course for all aspects of the park's future including developing partnerships to assist in achieving the park's purpose and management objectives.

Park staff provide the full scope of functions and activities to accomplish management objectives and meet requirements in law enforcement, emergency services, public health and safety, science, resource protection and management, visitor services, interpretation and education, community services, utilities, housing, fee collection, and management support.

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This section describes the environmental consequences associated with no action and the action alternatives. It is organized by impact topics, which distill the issues and concerns into distinct topics for discussion. These topics focus the presentation of environmental consequences and allow a standardized comparison among no action and the action alternatives based on the most relevant topics. (See the "Issues and Impact Topics" section under "Impact Topics Addressed" for further discussion.)

All action alternatives in this document implement a portion of phase 1 of the approved 1995 *General Management Plan*. The 1995 plan broadly presented the parkwide environmental consequences of implementing the plan, which included the Mather Point orientation and transit center, the removal of some facilities, and the restoration of the affected sites to natural conditions.

The environmental consequences of implementing any of the action alternatives in this document should not be viewed as an individual event, isolated to a single point on the South Rim. Implementing any of the action alternatives would be the first of many correlated actions throughout the park, and should be viewed in a parkwide context. Please review the environmental consequences section of the proposed action in the 1995 *Draft General Management Plan / Environmental Impact Statement* (p. 224) for a complete description of the environmental consequences.

Lastly, only those environmental consequences associated with the three action alternatives for the Mather Point orientation and transit center have been analyzed in this document. The environmental consequences for the Tusayan gateway facility and that portion of the transportation corridor between the Tusayan gateway facility and the park's southern boundary will be presented in the U.S. Forest Service's environmental impact statement as described in "The Alternatives" section of this document under the "Assumptions Used in Developing Action Alternatives."

IMPACTS OF NO ACTION

Biotic Communities

Analysis. As detailed in the *Draft General Management Plan / Environmental Impact Statement* (p. 196), existing impacts on biotic communities would continue. These impacts would be those associated with routine maintenance and minor repairs of South Rim roads, formal pullouts, and associated facilities. Informal pullouts would continue to grow in size and number; vegetation and biotic communities would be affected by some loss of individuals and available habitat.

Conclusion. Existing impacts would continue from routine maintenance of roads, pullouts, and associated visitor use facilities. Informal pullouts would continue to grow in size and number.

Air Quality

Analysis. As visitation and the number of private vehicles continue to increase, further degradation of air quality would result.

Conclusion. Further degradation of air quality would result from increased visitors and use of private vehicles.

Noise

Analysis. Although noise from rim operations are not overly significant within the canyon, continued vehicle operations on the rim have a negative impact on the visitor experience, especially those who seek solitude in the park.

Conclusion. The visitor experience would continue to degrade as vehicle numbers increase with increased visitation.

Cultural Resources

Analysis. As detailed in the *Draft General Management Plan / Environmental Impact Statement* (p. 198), there would be no new impacts on cultural resources, with the possible exception of five archeological sites originally impacted by the construction of the South Entrance Road, which provides access to Mather Point. The five sites consist of scatters of pottery and stone fragments; one also contains evidence of historic use.

As park visitation increases and crowding continues, the parking area at Mather Point would continue to be filled to capacity on an increasingly frequent basis. Cars parked illegally along the road shoulders approaching Mather Point could have an

adverse impact on the five archeological sites. Impacts would consist of vehicles compacting soil surrounding pottery fragments, crushing the fragments, and visitors picking up and removing exposed fragments.

There would continue to be adverse effects on the historic scene of the Grand Canyon Village Historic District from vehicular traffic congestion.

Conclusion. The five archeological sites originally impacted by the construction of the South Entrance Road could be adversely affected by cars parked illegally along the road shoulders approaching Mather Point. Congestion would continue in the historic district.

Visitor Experience

Analysis. As detailed in the *Draft General Management Plan / Environmental Impact Statement* (p. 204), there would be minimal impact on the South Rim visitor experience during the winter months. Visitation and vehicle numbers are at the lowest points during winter months. There are little if any lines waiting to enter the South Entrance, South Rim roads are not congested, and parking is adequate; the village roads would be expected to continue to operate at LOS C or better. The visitor would have ample opportunity to understand the road system, find a parking spot, and gather orientation at the visitor center. Thus, the purpose of Grand Canyon park roads would be maintained; they would provide a leisurely route for visitors to enjoy the South Rim and its numerous experiences and opportunities, thereby contributing to a rewarding and satisfying experience.

Also as detailed in the draft plan and environmental impact statement on p. 204, visitors during the summer months would continue to encounter long lines of vehicles waiting to enter the South Entrance, congested roads, and inadequate parking. Orientation and interpretive services would continue to be inadequate because many visitors would become frustrated by the lack of parking at the visitor center, and, once inside the visitor center, they would encounter long lines of people at the information counter.

There would be no transportation cost of public transit to visitors.

Conclusion. There would be little effect on the off-season visitor experience. Summer-use visitor experience would continue to deteriorate.

Scenic Values

Analysis. The current scenic values would be retained.

Conclusion. There would be no new impacts on scenic values.

Traffic Management

Analysis. As detailed in the *Draft General Management Plan / Environmental Impact Statement* (pp. 199 and 204), there would be no new impacts on traffic management for the off-season (winter) use under no action.

Also, as detailed in the draft plan and environmental impact statement (pp. 199 and 204), during the summer the village transportation system would continue to be inadequate. Private vehicles would continue to be the primary way for visitors to move about on the South Rim. Longer lines waiting to enter the South Entrance would be common; summer traffic congestion in the village would persist and worsen as visitation increases. Visitors waiting to use the village shuttle would experience longer delays, both waiting for a shuttle and while riding it, because individual shuttles would become stalled in clogged traffic. The village road system would be expected to continue to operate at LOS D/E or even LOS F.[1]

Parking areas and South Rim vista points would continue to be inadequate and overloaded. As visitation increases, more visitors would spend more time simply searching for a parking spot. Inadequate parking would continue to force many visitors to park illegally anywhere they could drive off the road. Parking along roadsides and road shoulders would create further traffic problems by restricting road widths.

Eventually, as visitation grows and traffic becomes totally unmanageable, the potential of establishing a South Rim day use limit and restricting summer day use by developing and implementing a reservation system may need to be reconsidered. Based on carrying capacity and/or similar studies, the number of visitors and vehicles that could enter the South Rim on a daily basis could be set, and once that number was reached, visitors would be asked to go to another part of the park or make reservations for another day. This possibility was raised and analyzed in alternative 1 of the 1995 draft plan and environmental impact statement.

Conclusion. There would be no impact on off-season traffic management. During the summer, the village transportation system would continue to be inadequate.

Park Operations

[1] A level of service (LOS) analysis provides a way to assess the operation and effectiveness of a road system. Based on individual road characteristics, the LOS analysis establishes the carrying capacity of the road. Level of service is rated from LOS A, representing excellent operation, to LOS F, representing system failure, which indicates gridlock; roads and parking areas are saturated and filled to capacity, traffic ceases to flow, and speeds are at or near 0 mph.

Analysis. Existing park operation problems, such as providing quality transportation, parking, and orientation and interpretation services in the South Rim, especially for an ever-increasing summer visitor population, would continue. During the summer months, park protection rangers are required to spend a great deal of their time assisting visitors who are involved in traffic accidents, are lost, park illegally, or seek information.

Conclusion. Existing park operation problems, especially during the summer, would continue.

IMPACTS COMMON TO ALL ACTION ALTERNATIVES

Biotic Communities

Analysis. To construct the Mather Point center with the buildings, visitor loading/unloading areas, plazas, trails, tour bus parking lot, water tank, and about 1 mile of new access roads (two road segments and the road at Mather Point) would disturb about 23 acres of piñon/juniper habitat. Some of the facilities would be constructed on previously disturbed areas (utility corridors, old roadbeds, burned areas, etc.). About 1 acre, such as parking lot islands, would be landscaped with native vegetation. About 6 acres of previously disturbed piñon/juniper habitat would be restored to natural conditions by the removal of the South Entrance Road.

The total gross area affected by construction would be about 23 acres. However, disturbed areas (roads, etc.) to be restored to natural conditions and landscaping with native vegetation within the project area would amount to about 7 acres. Thus, the net area adversely affected would total 16 acres.

Most impacts on vegetation and soils would be caused by constructing buildings, parking areas, trails, roads, and other similar facilities or removing such facilities and the subsequent restoration of the vacated area. An additional area, the construction zone surrounding each project site, would also be disturbed; soils would be exposed and some vegetation would be removed. However, impacts on soils, particularly within the construction zones, would be mitigated by defining the construction zones with construction tape or fencing, and installing soil erosion devices and measures as described in the "Mitigation Measures" section of this environmental assessment.

Impacts on soils from construction include trampling, digging for foundations, road base preparation, and cuts and fills, and some soils would be covered with impermeable materials such as buildings, asphalt, and concrete. Surface soil horizons would be altered, topsoil would be removed, and some soil would be compacted and compressed. These consequences would result in a localized decrease in soil permeability to water and air, alteration of soil regime, and an increase in localized runoff and channelization. These effects would be mitigated as described in the "Mitigation Measures" section. In some areas, a number of facilities or structures would be removed or relocated. Once the structure is removed, the site would be returned to natural conditions by scarification, which would decompact the soil; the site topography would be returned to its preconstruction contours. The site may either be allowed to revegetate itself naturally or it could be revegetated with species native to the immediate area. Revegetation would facilitate soil stability, help to reduce runoff, channelization, and erosion, and help the soil to restore itself to natural conditions.

Indirect impacts on vegetation can be expected as the result of compacted soils. Plant seedlings generally fail to penetrate compacted soil and usually die before

becoming established. Also, water and air do not percolate well through compacted soils; lack of water and air in soil also contributes to increased seedling mortality. Indirect impacts on vegetation would also result from foot traffic. Foot traffic to and around buildings and visitors wandering off established trails would trample vegetation thus damaging or killing seedlings and similar small plants.

Most impacts would occur within the piñon/juniper habitat, although some impacts on the big sagebrush habitat would also be expected. These habitats are abundant throughout the park and the region, and the loss of 16 acres of these habitats would result in no appreciable effect on the overall communities or their species composition.

Vegetation would be removed from the building sites. Other vegetation would be trimmed and thinned within 30-100 feet of each structure to reduce wildfire hazard. Drought-tolerant and fire-resistant species would be used to landscape or revegetate areas around structures.

As stated earlier, piñon/juniper and big sagebrush habitats are common habitats found throughout the region and on the South Rim; most of the existing South Rim developments have occurred in these habitats. As a result of these development actions, some degree of habitat fragmentation has already occurred.

Factors contributing to and influencing habitat fragmentation are difficult to measure and are not completely understood. Elements known to contribute to ecosystem fragmentation at Grand Canyon National Park include (1) reducing the size of "ecosystem islands" or continuous habitat areas and (2) developing buildings, roads, fences, or trail barriers that prevent smaller wildlife species such as amphibians and reptiles from moving from area to area. It is anticipated that the loss of wildlife would be proportional to the amount of habitat lost. Portions of the project site have been previously affected because of periodic fires, nearby utility corridors and roads, and attendant human activity. During construction some small animals might be killed or forced to relocate to areas outside the construction zone. Overall populations of affected species would be slightly and temporarily lowered during construction; however, once construction was completed and mitigation measures employed, population levels would be expected to recover to some degree. Additionally, landscaping and currently impacted areas that would be restored to natural conditions would provide new wildlife habitat.

Large zones of existing open space would be retained as landscaped areas within the developed environment; this would help maintain the environmental requirements necessary for native vegetation to thrive and reproduce and, therefore, aid in the preservation of natural habitats. Wildlife would thus be less affected by the continued existence of large, continuous areas of open space. Although construction would contribute to habitat fragmentation at Mather Point, the project area is small in scope when taken in context of the entire South Rim and similar habitats throughout the region. Therefore, the overall effect of construction and post construction activities on wildlife populations at the South Rim would not be appreciable.

Development of the Mather Point facility would expand the area of visitor/wildlife contact. It would be expected that the current visitor practice of illegally feeding animals, such as deer and squirrels, would continue. Such contact tends to domesticate some wildlife individuals, adversely affects natural wildlife behavior, and exposes visitors to an element of risk. Visitors would be discouraged from feeding wildlife through

education and law enforcement. Additionally, relocation of the domesticated wildlife individuals, as has been done in the village area, would continue.

Conclusion. Approximately 23 acres of piñon/juniper habitat would be impacted. Approximately 7 acres of currently disturbed habitat would be restored leaving a net impact of 16 acres. Some habitat fragmentation would occur. Overall populations of affected species would be slightly and temporarily lowered during construction; however, once construction was completed and mitigation measures employed, population levels would be expected to recover to some degree. Additionally, landscaping and currently impacted areas that would be restored to natural conditions would provide new wildlife habitat. Minor short-term impacts on local water quality may occur during construction; however, measures would be taken to minimize impacts.

Air Quality

Analysis. All action alternatives dictate a reduction in the amount of driving associated with private vehicles, especially in the village area. The typical visitor who stops at an overlook, drives to another and stops, drives to a restaurant and parks, etc., would be replaced by the typical visitor who parks once and then uses transit service. As private vehicular traffic is reduced and lower emission transit vehicles are encouraged, emissions affecting the quality of the air over the Grand Canyon would also be reduced. The action alternatives differ, however, in the number of private automobiles allowed to park at Mather.

Restricting day use vehicles from the South Rim would remove up to 80% of the traffic in the village, thereby improving park air quality over existing levels. Directing all village day use traffic to park at the Tusayan gateway facility would not be expected to increase emissions beyond present levels at or near the community of Tusayan because all vehicles parked there would already be traveling through Tusayan. Additionally, as described in the Draft General Management Plan / Environmental Impact Statement (p. 225), a number of actions would be implemented or encouraged to reduce air pollution inside the park. These actions include an increased emphasis on hiking, biking, and shuttle use; providing employee shuttles; and requiring buses to turn off their engines while waiting and loading/unloading passengers.

Should any of the action alternatives be selected, local air quality would be temporarily affected by dust and vehicle emissions. Hauling material and operating equipment during the construction period would result in increased vehicle exhaust and emissions. Hydrocarbons, NO_x, and $S0_2$ emissions would be rapidly dissipated by air drainage since air stagnation is rare at the project site.

Conclusion. Short-term, minor impacts on air quality during construction would occur. However, measures would be implemented to reduce impacts of fugitive dust during construction (see the "Mitigating Measures" section). Reductions in emissions that affect air quality over the Grand Canyon would be the result of any of the transportation alternatives.

Noise

Analysis. Controversy regarding aircraft overflights and the effect of aircraft noise on the visitor experience points to the importance of attempting to reduce all noise sources, so it is important that rim sources of noise also be reduced or eliminated. As private vehicle traffic is reduced, noise from

vehicles, within the canyon and on the rim, would also be reduced.

Conclusion. There would be some reduction in traffic noise from private vehicle traffic.

Cultural Resources

Analysis. Removal of the parking lot at Mather Point would not result in the removal of a contributing element of the cultural landscape. Expansion of the existing overlook, and changes to elements of its design may affect the existing cultural landscape, but it is not anticipated that these changes would be adverse. Design concepts important as contributing elements of the cultural landscape (e.g., an island of vegetation between open public spaces and the rim view area, private enclaves to provide intimate viewing spaces, the use of field stone for curbing and, low, curving stone walls that blend with the surrounding landscape, and/or transparent safety railings) will be retained in any new design.

Three archeological sites would be destroyed by the construction of the Mather Point orientation and transit Center. Two of these sites represent limited activity artifact scatters of unknown origin, while the other represents historic occupation of the area by either the Havasupai or Navajo. An additional six sites will receive indirect impacts from the project due to construction activities, road realignment, and increased visitor use of the area.

Although the National Park Service has been consulting with tribal groups about this project, the effects on ethnographic resources are unknown. None of the archeological sites that would be affected appears to contain human remains, so it is anticipated that there would be no impacts on burial sites.

Conclusion. At least nine archaeological sites would be affected. None of these effects is expected to be adverse, and all effects can be mitigated.

There would be no adverse effects on the cultural landscape. There would be an overall beneficial effect on the historic district from the decreased vehicular congestion and quieter surroundings.

Visitor Experience

Analysis. During construction activities, visitors using the South Entrance Road would be subjected to the increased commercial truck traffic hauling construction material, and noise, dust, and visual intrusion.

Construction vehicles associated with the project would contribute to already heavy traffic using the South Entrance and South Entrance Road. At times, summer visitors entering the park through the South Entrance would experience traffic delays due, in part, to construction vehicles sharing the South Entrance with visitor traffic. Although visitors caught in the delays would be frustrated and consider the delays interminable, major construction-related traffic delays would not be anticipated.

From the Mather Point orientation and transit center visitors would catch shuttles to their South Rim destinations, or they could hike or bike. By removing private vehicles and tour buses from the South Rim and providing shuttles running on regular and dependable schedules, summer visitors would no longer face the confusion, congestion, and frustration of overcrowded roads and parking areas.

Parking at Yaki Point would be reserved for shuttle vehicles. This would eliminate competition for parking spaces and

hazardous road conditions and create more pedestrian space and enhance the visitor experience at the overlooks.

Providing safe bike trails linking all major use areas and new rim trails would give visitors alternative ways to safely view the park and experience the resources. Shuttle vehicles would have bike racks.

In the year 2000 there would be a $.91 transportation cost for each visitor for the shuttle service; this fee would drop to $.81 in the year 2010. The transportation cost would be included in the park entrance fee.

The Mather Point center would provide orientation and introduction to all park themes. Visitors would benefit from a more conveniently located and centralized orientation and interpretive facility and generalized interpretation focusing on all park themes; point specific detailed interpretation would be provided at specific points throughout the park and accessed by transit service, walking, or biking.

The Mather Point site is within a principal vista viewing area and adjacent to the South Entrance Road, the primary park access route. The Mather Point viewing area would be closed to visitor use during the construction period. Over the short term, some visitors would be dissatisfied because they would be unable to experience the area due to construction; however, the area would be closed only as long as construction would occur. Once construction is complete, expanded interpretive and viewing opportunities would be provided, thus enhancing interpretation and vista viewing of this part of the Grand Canyon.

Conclusion. Over the short term, the visitor experience would be adversely affected by noise, dust, fumes, delays, and construction vehicle traffic for the duration of construction activities. Some visitors would be dissatisfied because they would no longer be allowed to drive their personal vehicles into Grand Canyon Village and would have to leave their cars at Tusayan. Over the long term, the function of South Rim roads would be restored to the purpose of providing a safe, leisurely, and enjoyable route for relaxed sightseeing. By receiving orientation and interpretation early in their visit at the Mather Point orientation and transit center, visitors would be able to tailor their visit with their needs by choosing from a variety of transit routes leading to various park destinations. Summer visitors would experience less congestion than currently experienced.

Scenic Values

Analysis. At a distance of 200 feet south of the existing road at Mather Point, the siting of the facility would take advantage of the natural vegetative screening and a drop in grade to disguise the presence of the Grand Canyon. As visitors approached the rim, the anticipatory aspect of the site would thus be retained and enhanced which would foster the elements of surprise and revelation at the rim. The views by visitors looking back from the rim would not reveal the development from which they came. Instead, the leisurely return walk would allow for passive reflection.

The Mather Point orientation and transit center would be screened as much as possible by existing vegetation and landscaping efforts. Overall design considerations include the *Grand Canyon National Park Architectural Character Guidelines* to construct the facilities in a manner conducive and supportive of the natural environment. The Mather Point center would not be visible from other locations on the South or North Rims and no vistas would be altered.

Park guidelines and the Coconino County ordinance would be followed in the exterior lighting design. Exterior lighting would not be visible outside the immediate area.

Conclusion. No adverse impacts would be expected, although the Mather Point scenery would be changed. New facilities would blend with and complement existing environments and vistas. Building design and color scheme, plantings around the structures, and spatial orientation would all reduce the visibility and enhance the appearance of the structures. Views of the Grand Canyon would be enhanced over the long term. Views of Mather Point from the North Rim and from within the canyon would not be affected.

Traffic Management

Analysis. Impacts on visitor traffic during construction would be mitigated by those actions previously described in the "Mitigation Measures" section.

Over the long term, traffic problems in the South Rim and Grand Canyon Village would be greatly reduced.

Since the Grand Canyon Village would be closed to day use, private automobile traffic year-round, the roads would be operating below their capacity, congestion would be abated considerably, and the South Rim road system would be expected to function at LOS B or better. Shuttle transit service would experience minimal delays and would run on dependable and regular schedules.

Conclusion. Impacts on visitor traffic during construction would be mitigated by those actions previously described in the "Mitigation Measures" section. Over the long term, traffic problems in the South Rim and Grand Canyon Village would be greatly reduced. Since the Grand Canyon Village would be closed to day use, private automobile traffic year-round, the roads would be operating below their capacity, congestion would be abated considerably, and the South Rim road system would be expected to function at LOS B or better.

Park Operations

Analysis. The processes of resource management and providing for a quality visitor experience would be appreciably enhanced. The South Rim roads would be closed to day use visitor traffic; this would reduce the amount of traffic and associated wear and tear on the roads. This would extend the service life of the roads by perhaps as much as several decades.

During the summer months, park protection rangers would spend less time assisting visitors who become involved in traffic accidents, are lost, parking illegally, or seeking information than under current conditions.

The annual operation and maintenance cost for the shuttle bus service would be $3.1 million; annual capital cost would be $2.4 million.

Conclusion. Park operations would be greatly helped. The roads would remain serviceable for several decades without major maintenance needs; time spent by park staff conducting road repairs would be reduced.

IMPACTS OF ALTERNATIVE A

Biotic Communities

Analysis. In addition to the impacts described in the "Impacts Common to All Action Alternatives" section, an additional 11 acres of piñon/juniper habitat would be impacted by constructing a parking lot for

841 cars and 42 RVs at the Mather Point orientation and transit center. Minor impacts on biotic communities would result from removal of trees and vegetation.

Conclusion. Minor impacts on biotic communities would result from the removal of 11 acres of piñon/juniper habitat for the construction of a parking lot for 841 cars and 42 RVs at the Mather Point orientation and transit center.

Air Quality

Analysis. The primary difference in this alternative is that 841 cars and 42 RVs would be allowed to travel to and park at the Mather Point orientation and transit center. Although this number would be appreciably less than the number currently traveling within the park, the air quality would continue to be affected during the park summer season.

Conclusion. Short-term impacts on air quality would result from construction activities related to the new parking lot. Impacts on air quality would be reduced by limiting private vehicles in the park. Use of alternative fuels for the transit buses would also help reduce vehicle emissions.

Noise

Analysis. Under alternative A, continued private vehicle parking at Mather Point would have some impact on visitors.

Conclusion. Short-term noise impacts from construction of the parking lot would occur. Over the long term, reduction in the number of private automobiles would reduce overall noise impacts on visitors.

Cultural Resources

Analysis. In addition to the nine archeological sites that would be affected under all alternatives, five archeological sites would be destroyed by construction of the parking for day-use visitors and buses. One of the sites consists of scatters of stone debitage, and one was probably used by Havasupai or Navajo people in the early 20th century. Three consist of widespread scatters of ceramic sherds dated to ancestral Puebloan times.

Conclusion. Fourteen archeological sites could be affected by this alternative. In addition, at least one site could be at least indirectly affected by trail development along the rim. None of these effects is expected to be adverse, and all effects can be mitigated.
There would be no adverse effects on the cultural landscape.

Visitor Experience

Analysis. During the months of June through early September, it is anticipated the Mather Point orientation/transit center parking area would be at capacity most of the time, and it would be a common occurrence for most visitors to access the South Rim by taking public transit from the Tusayan gateway facility. This would be an inconvenience and a source of frustration for most affected visitors.

During the winter months of December, January, and February, the Mather Point orientation/transit center parking area would be open but the transportation service would be closed. Parking outside the park and finding transportation to the Mather Point center would be difficult because the Tusayan gateway facility and public transportation service would be closed.

In the year 2000 there would be a $1.20 transportation cost for each visitor; this fee would drop to $1.18 in the year 201 O.This fee would be in addition to the shuttle service fee as discussed in the "Impacts Common to All Alternatives" section. The transportation cost would be included in the park entrance fee.

Conclusion. Overall impacts on the visitor experience under this alternative would not be appreciable.

Scenic Values

Analysis. As in the "Impacts Common to All Alternatives," fewer private vehicles and more buses using the road would not appreciably affect South Rim scenic values. However, an additional 11 acres would be paved for the parking lot at the Mather Point orientation and transit center, and this would have a moderate impact on scenic values. Vegetative screening would be used to soften the appearance of the lot.

Conclusion. The impacts on scenic values under this alternative would be moderate

Traffic Management

Analysis. In addition to the impacts described in the "Impacts Common to All Action Alternatives" section, the provision for allowing 841 cars and 42 RVs at Mather Point orientation and transit center would have an impact on traffic flows and circulation. Roads west of the Mather Point center would be closed, and those traveling by car would park at Mather Point and board shuttle buses to reach their destinations. Traffic to and from the Mather Point orientation and transit center would be managed similar to what is occurring now, except that far fewer vehicles would be allowed to enter the park.

Conclusion. Over the long term, traffic management under this alternative would be improved as less vehicles travel to and from Mather Point.

Park Operations

Analysis. In addition to impacts described in the "Impacts Common to All Action Alternatives" section, park protection rangers would be required to deal with any inconvenienced and frustrated visitors who would be turned away from the Mather Point center if the parking lot is at capacity.

Under this alternative, facilities proposed for the bus maintenance area would be constructed at the 30-acre dry dump area. Facilities would include a helibase operation, garages, fuel storage and fueling capabilities, administrative offices, and other similar functions. The existing dry dump site would be for helibase operations while the other facilities would be expanded to the east. The area affected for the eastward expansion would be about 13.5 acres and was analyzed in the *Final General Management Plan / Environmental Impact Statement* (p. 52).

For the year 2010, an additional staff of 93 people would be needed to operate the transit system from the Tusayan gateway facility to the Mather Point orientation and transit center during the summer. The estimated cost for the visitor transit system would include $5.3 million for annual operation and maintenance; annual capital cost would total $2.8 million.

Conclusion. Over the long term, park operations would improve with implementation of a transit system. Limited private automobile parking at Mather Point would require coordination and management to reduce conflicts.

IMPACTS OF ALTERNATIVE B

Biotic Communities

Analysis. Impacts on biotic communities for this alternative would be the same as those described in the "Impacts Common to All Action Alternatives" section. This alternative would preclude the need for private automobile parking at Mather; therefore 11 acres would not be disturbed.

Conclusion. No additional habitat beyond that identified in "Impacts Common to All Alternatives" section would be affected by implementation of the visitor transit system under alternative B.

Air Quality

Analysis. Alternative fuel buses would be used to reduce vehicle emissions, resulting in a significant reduction in air quality impacts when compared to existing conditions. Quantitative data is not available to determine the total reduction in emissions.

Conclusion. Use of alternative fuel buses and elimination of private vehicles on the South Rim would have long-term beneficial impacts on air quality.

Noise

Analysis. Use of alternative fuel buses would eliminate the need for private vehicles and thereby reduce noise. Buses would use the latest technology (initially liquefied natural gas with eventual conversion to battery or fuel cell) to minimize noise impacts.

Conclusion. The use of a public bus system between Tusayan and Mather Point would have long-term beneficial impacts on noise levels.

Cultural Resources

Analysis. There would be no additional impacts on cultural resources under this alternative beyond those described in the "Impacts Common to All Action Alternatives" section.

Conclusion. There would be no additional impacts beyond those common to all action alternatives.

Visitor Experience

Analysis. Impacts on the visitor experience for this alternative would be the same as those described for Alternative A, except no private vehicles would be allowed to park at the Mather Point orientation and transit center. Some visitors may experience some inconvenience waiting for transit buses; however, regularly scheduled service every 2 to 8 minutes would be provided.

In the year 2000 there would be a $1.86 transportation cost for each visitor; this fee would drop to $1.62 in the year 2010. This fee would be in addition to the shuttle service fee as discussed in the "Impacts Common to All Alternatives" section. The transportation cost would be included in the park entrance fee.

Conclusion. Visitors may experience some inconvenience waiting for transit buses; however, regularly scheduled service every 2 to 8 minutes would be provided. Overall impacts on the visitor experience would be minor.

Scenic Values

Analysis. Impacts would be similar to alternative A except that a parking lot (11 acres) would not be constructed at Mather Point. With less disturbance there would be beneficial impacts on scenic values.

Conclusion. Overall impacts on scenic values would be beneficial.

Traffic Management

Analysis. Approximately 54 buses would be needed to operate during peak season between Tusayan and Mather Point and within the village. Traffic management issues would shift from private vehicles to managing the circulation of buses to and from Mather Point and within the village. The volume of people and buses would require careful consideration of circulation and adequate information to avoid congestion and confusion.

Conclusion. Over the long term, there would be beneficial impacts on traffic management.

Park Operations

Analysis. Park operations would be improved by most summer visitors arriving at the South Rim by public transportation. For the year 2010, an additional staff of 108 people would be needed to operate the bus system from the Tusayan gateway facility to the Mather Point orientation and transit center during the summer. The estimated cost for the visitor transit system would include $7.3 million for annual operation and maintenance and $3.8 million annual capital cost.

Under this alternative, facilities proposed for the bus maintenance area would be constructed at the 30-acre dry dump area. Facilities would include a helibase operation, garages, fuel storage and fueling capabilities, administrative offices, and other similar functions. The existing dry dump site would be for helibase operations while the other facilities would be expanded to the east. The area affected for the eastward expansion would be about 13.5 acres and was analyzed in the *Final General Management Plan / Environmental Impact Statement* (p. 52).

Conclusion. Long-term impacts would be beneficial from elimination of all private automobiles from Mather Point.

IMPACTS OF ALTERNATIVE C

Biotic Communities

Analysis. Impacts on biotic communities for this alternative would be the same as those described in the "Impacts Common to All Action Alternatives" section, with the following exceptions.

Constructing a dedicated light rail transportation system from the south park boundary to the Mather Point orientation and transit center, on through the village to the Maswik Transportation Center, and back to near the junction of Center and South Entrance Roads would impact a corridor of about 33.5 acres, most of which would be through piñon/juniper habitat, although some Ponderosa pine habitat would be affected.

For much of its length, however, the route would be constructed on abandoned roads, previously impacted areas, and along utility corridors thereby minimizing impacts. Impacts on the vegetative component of the biotic community would be principally on immature piñon, juniper, and understory species.

Impacts on wildlife from constructing and using the transportation corridor would be to further reduce and fragment available habitat. The corridor would create another

obstruction for wildlife movement in the area; some wildlife kills would be expected but with no more frequency than what now takes place in the park. However, it is not anticipated the effects on biotic communities, community members, or biotic processes would be appreciable when viewed in context of the entire South Rim habitat.

Conclusion. A total of 33.5 acres of piñon/juniper woodland and some Ponderosa pine habitat would be disturbed for construction of a light rail transportation corridor. This would be a minor impact on biotic communities.

Air Quality

Analysis. Implementation of a light rail system would reduce the number of total vehicles in operation. Although new diesel engines are cleaner than ever, diesel would not be as clean as natural gas fuel, which might be available for light rail cars. Electric light rail cars would be even less polluting at the local level but are not evaluated here because initial infrastructure costs are substantial. Emissions from a light rail system, regardless of fuel, would not have adverse impacts on air quality.

Conclusion. Implementation of alight rail system would have long-term benefits on air quality. The cleanest affordable fuel would be specified.

Noise

Analysis. A light rail train would operate with the latest technology to minimize noise intrusions. The system would further reduce the number of vehicles in the park and therefore have reduced levels of noise impacts. For the foreseeable future, light rail cars without overhead electric wires would be powered by internal combustion engines, which are noisy. If fuel cell or other on-board electric options become feasible, conversion would be considered.

Conclusion. The long-term impacts on noise levels from implementation of a light rail system would be beneficial due to overall reduction in vehicular traffic.

Cultural Resources

Analysis. In addition to the "Impacts Common to All Action Alternatives" section, at least 14 archeological sites could be affected by the construction of a dedicated transit corridor for light rail that parallels the South Entrance Road. About 1/8 of that route has not been surveyed for archeological sites, thus the number of sites to be affected could increase as the surveys are completed.

Only a portion of the west loop of the dedicated rail way has been surveyed as well. Of the portion that has been surveyed, three sites could be affected by construction. Two of these sites are widely spaced historic period sites associated with early hotel and tourism activities and would require extensive mitigation measures.

Of the 14 archeological sites that could be affected, four are of known Cohonino or ancestral Puebloan affiliation, and one is a historic Havasupai site. While these types of sites have not yielded burials on the South Rim in the past, there is always a potential for human remains to be found on the sites. If specific memorandums of understanding have not been negotiated with the tribes for treatment of human remains that might be encountered during construction activities, and if the tribes so request, the National Park Service would provide for American Indian monitors during ground-disturbing activities in the vicinity of these sites for each visitor; this fee would drop to $1.42 in the year 2010. This fee is in addition to cost per visitor for

the shuttle bus service as discussed in the "Impacts Common to All Action Alternatives" section. The transportation cost would be included in the park entrance fee.

Conclusion. The Grand Canyon Village historic district would be affected by the presence of the light rail along the historic railway corridor. In addition, a 9-12 foot section of historic stone wall would be breached. This action may constitute an adverse effect on the historic district. In addition to the nine sites impacted by all alternatives, at least 14 sites or more could be impacted by the construction of a dedicated transportation corridor from Tusayan to Mather Point. None of these effects on archeological or ethnographic resources is expected to be adverse, and all effects can be mitigated.

Visitor Experience

Analysis. Public transportation for day use visitors, other than those arriving by tour bus, would be provided by light rail between the Tusayan gateway facility and the Mather Point orientation/transit center. Service provided on a light rail car has some advantages over buses because they are more spacious, employ level loading at all stops, include interior bike racks, and can be fitted with a video system. In the year 2000 there would be a $1.85 transportation cost

Scenic Values

Analysis. The light rail corridor, and the frequently run light rail itself, up to Mather Point and looping through the village may be perceived as a visual intrusion. For much of its length, however, the corridor would be screened by tall trees and dense forest and impacts on scenic values are not expected to be appreciable. Where the light rail would travel through Grand Canyon Village, it would be another element in the built, essentially urban environment. Impacts would be minor through the corridor.

Conclusion. The impacts on scenic values would be minor.

Traffic Management

Analysis. The light rail would be sharing the transportation route with the village loop road, and would require traffic crossings at Center Road, the new campground access road, and at a number of locations within the village. Such crossings would be constructed according to all safety codes. Additionally, in order to maintain separation of light rail and wheeled vehicles, individual transportation corridors would be identified within the transportation route. To enhance traffic management and safety, the individual transportation corridors would be physically separated and, possibly, landscaping would be developed between them.

Conclusion. The impacts on traffic management would be minor.

Park Operations

Analysis. The facility footprint and many of the functions would be the same as for alternative A. However, in this alternative, shuttle buses would run only to Yaki Point and the West Rim Drive. A light rail system would transport visitors between Mather Point and the Tusayan Gateway facility. Light rail would also circulate visitors within the village. Although facilities and maintenance requirements would be required for light rail, fewer buses and fewer bus maintenance facilities would be required. Under this alternative, facilities proposed for the bus maintenance area would be constructed at the 30-acre dry dump area. Facilities would include a helibase operation,

garages, fuel storage and fueling capabilities, administrative offices, and other similar functions. The existing dry dump site would be for helibase operations while the other facilities would be expanded to the east. The area affected for the eastward expansion would be about 13.5 acres and was analyzed in the *Final General Management Plan / Environmental Impact Statement* (p. 52).

Approximately 26 people would be needed to operate the light rail system during the summer peak season. A total of 10 light rail cars would be needed for operation of the system. The estimated costs for the light rail system are as follows: $6.8 million annual operation and maintenance cost and $2.7 million annual capital cost.

Conclusion. Long-term impacts on park operations would be beneficial. The light rail system would provide a single system of traffic movement to and from and within the South Rim.

CUMULATIVE IMPACTS

The Council on Environmental Quality regulations, which implement the National Environmental Policy Act, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives.

The cumulative actions of constructing the Mather Point orientation/transit center and operation of a transit system of either a light rail system or bus service would not have cumulative impacts beyond those described in the 1995 *Draft General Management Plan / Environmental Impact Statement* (pp. 198, 201, 203, 207, 209, 228-230, 233, 236, 239, 242, and 249).

TABLE 6: AREA OF IMPACT BY ALTERNATIVE (ALL FIGURES ARE IN ACRES)

ELEMENT	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Building area:			
Enclosed interior	0.5	0.5	0.5
Covered exterior	0.5	0.5	0.5
Uncovered exterior	1.0	1.0	1.0
Total	2.0	2.0	2.0
Trails			
Trail to/from rim	0.5	0.5	0.5
Overlook	0.5	0.5	0.5
Total	1.0	1.0	1.0
Revegetation			
Existing parking area	1.0	1.0	1.0
South Entrance Road	6.0	6.0	3.5
Total	7.0	7.0	4.5
Parking			
Car parking	11.0	N/A	N/A
Bus parking	9.0	9.0	9.0
Transit/shuttle	4.0	4.0	N/A
Total	24.0	13.0	9.0
Light Rail			
Previous disturbed	N/A	N/A	12.5
New disturbed	N/A	N/A	21.0
Total	N/A	N/A	33.5
Total Areas Affected	**34.0**	**23.0**	**50.0**

COMPLIANCE

This *Environmental Assessment* provides disclosure of the planning and decision making process and potential environmental consequences of the proposed alternatives. The analysis of environmental consequences was prepared on the basis of a need to adequately analyze and understand the consequences of the impacts related to the proposed park developments and to involve the public and other agencies in the decision making process.

The environmental analysis was prepared in accordance with the regulations of the Council on Environmental Quality (40 CFR 1500 et seq.) and in part 516 of the U.S. Department of the Interior's *Departmental Manual* (516 DM).

The National Environmental Policy Act of 1969 is the basic national charter for environmental protection; among other actions it calls for an examination of the impacts on the components of affected ecosystems. The 1988 *NPS Management Policies*, NPS-77: *Natural Resources Management Guideline*, 1985 *Statement for Management* for Grand Canyon National Park, and the 1995 *General Management Plan* for Grand Canyon National Park (among other NPS and park policies) provide general direction for the protection of the natural abundance and diversity of all the park's naturally occurring communities.

Various agencies have been contacted and consulted as part of this planning and environmental analysis effort. Appropriate federal, state, and local agencies have been contacted for input, review, and permitting in coordination with other legislative and executive requirements.

SPECIAL STATUS SPECIES (THREATENED, ENDANGERED, CANDIDATE, AND RARE SPECIES)

The 1973 Endangered Species Act, as amended, requires an examination of impacts on all federally threatened or endangered species. NPS policy requires examination of the impacts on state-listed threatened or endangered species and federal candidate species. In a letter dated October 8, 1996, the U.S. Fish and Wildlife Service provided a federal list of a number of special status species that have potential to reside in the project area or depend on it for critical habitat. In a letter April 29, 1996, the State of Arizona Game and Fish Department provided a statewide list of state of Arizona special status species and critical habitats (See appendix A for copies of above letters and lists.)

According to park records and field surveys of the project site conducted from 1990 to 1996, no threatened, endangered, or special status wildlife species on federal or state lists reside in the area of proposed development or depend on it for critical habitat. Although the peregrine falcon (*Falco peregrinus anatum*) (federally endangered) is occasionally seen flying over the project area vicinity, nesting sites are known to be within the canyon away from the project site, and due to the vicinity of the project area to human use, it is of little habitat value to the falcons.

No threatened or endangered plants on federal or state lists occur in the project area. A population of about 30 individuals of the Tusayan flame flower (*Talinum validulum*), a species of concern in Arizona and listed as a salvage restricted species by the Arizona Native Plant Law, inhabits an open area near Mather Point. Measures have been prescribed to avoid impact on this species (see the

"Mitigation Measures" section of this environmental assessment). Therefore, no biological assessment or further consultation under section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required.

FLOODPLAINS AND WETLANDS

Executive Orders 11988 ("Floodplain Management") and 11990 ("Protection of Wetlands") require an examination of impacts on and protection of floodplains and wetlands in the placement of facilities. The National Park Service's *NPS Management Policies* (1988), NPS-2: *Planning Process Guideline*, NPS-12: *NEPA Compliance Guidelines*, and the *General Management Plan* (1995) for Grand Canyon National Park provide direction on developments proposed in wetlands and floodplains.

Executive Order 11988 ("Floodplain Management") requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. Construction within a 100year floodplain requires that a statement of findings be prepared and accompany a finding of no significant impact. Executive Order 11990 ("Protection of Wetlands") requires federal agencies to avoid, wherever possible, impacts on wetlands. If required, a statement of findings would address any concerns for wetlands and also any permitting actions required under section 104 of the Clean Water Act and any state requirements.

The project site was surveyed for wetlands and floodplains. There are no jurisdictional wetlands or floodplains within the project site. The alternatives proposed by this environmental assessment do not propose any development that should have any impact on floodplains or wetlands. Consequently, statements of findings for either floodplains or wetlands will not be prepared in conjunction with the environmental assessment.

Drainage basin sizes of the project site are unknown. The 10-year storm flow likely does not exceed 15 cfs, and the five-year flow likely does not exceed 13 cfs. These figures are based on similar size washes on the South Rim. The washes are ephemeral and flow only during heavy rains. However, there are a several unnamed washes that may require minor recontouring and/or culverts as part of the design detail.

Prior to construction, the project area would be surveyed for drainages and potential washes that would need to be crossed. The U.S. Army Corps of Engineers would be consulted and necessary permits secured by the park or contractor.

SECTION 404 OF THE CLEAN WATER ACT (33 USC 1344) AND SECTION 10 OF THE RIVERS AND HARBORS ACT OF 1899 (33 USC 401 ET SEQ.)

The U.S. Army Corps of Engineers issues permits for work affecting navigable waters and wetlands of the United States. Construction requires a section 10 permit and discharge of dredged or fill material requires a section 404 permit. In addition, all projects requiring a federal license or permit that might result in a discharge into navigable waters of the state are subject to the state water quality certification program as a result of delegation of authority under section 401 of the Clean Water Act.

Prior to construction, the U.S. Army Corps of Engineers would be consulted and necessary permits secured by the park or contractor.

STORM WATER RULE

The Storm Water Rule (40 CFR, Parts 122, 123, and 124) requires a national pollutant discharge elimination system (NPDES) notice of intent be submitted to the Environmental Protection Agency, with a copy sent to the appropriate State Department of Environmental Quality, on construction activities in excess of five acres, e.g., clearing and grading, which may affect stormwater discharge.

Additionally, the NPDES process requires a storm water pollution prevention plan (SWPPP) be developed prior to any ground-disturbing activities that affect an area greater than 5 acres. A SWPPP is the guiding tool for the prevention, minimization, and mitigation of soil erosion and water pollution prevention during construction activities; the completed SWPPP must be available for public and agency inspection at the construction site.

Should any of the action alternatives be implemented, developments would occupy a minimum of 23 acres (alternative B), which would require clearing and grading for site preparation. An additional area, the surrounding construction zone, would also be disturbed; soils would be exposed and some vegetation removed. Soil erosion would be minimized; all required permits would be obtained, and a SWPPP would be developed and implemented. Once construction was completed, soils within the construction zone would be recontoured to preconstruction conditions and the area revegetated. Should any of the action alternatives be implemented, the contractor would be responsible for developing a park-approved SWPPP and making it available at the construction site.

CULTURAL RESOURCES

The National Park Service is mandated to preserve and protect its cultural resources through the Organic Act of August 25, 1916, wherein the National Park Service was established. Further mandates are provided through specific legislation such as the Antiquities Act of 1906 providing for protection of historic, prehistoric, and scientific features on federal lands; the National Environmental Policy Act of 1969 declaring a federal policy to preserve important historic and cultural aspects of national heritage; and the National Historic Preservation Act of 1966.

As part of its cultural resource management responsibilities, the National Park Service surveys and evaluates all cultural resources on lands under its jurisdiction. Resources are evaluated by applying the criteria for the National Register of Historic Places. In addition, the National Park Service maintains an inventory of all above grade historic and prehistoric structures within the national park system, which is called the List of Classified Structures. All cultural resources eligible for the National Register would be recorded and/or measured, according to the highest professional standards.

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED (16 USC 470, ET. SEQ.)

Section 106 requires that federal agencies having direct or indirect jurisdiction over undertakings take into account the effect of those undertakings on properties included or eligible for inclusion in the National Register of Historic Places and give the Advisory Council on Historic Preservation an opportunity to comment on proposed undertakings. The actions proposed fall under the 1995 programmatic agreement among the Arizona State Historic Preservation Office, the Advisory Council on Historic Preservation, and the National Park Service for the *Draft General Management*

Plan / Environmental Impact Statement for Grand Canyon National Park.

AMERICAN INDIAN RELIGIOUS FREEDOM ACT, AUGUST 11,1978 (P.L. 95-341; 92 STAT. 469) AND EXECUTIVE ORDER 13007

It is the policy of the United States to protect and preserve American Indians in their right of freedom to believe, express, and exercise traditional religions. This policy provides access to sacred sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT (P.L.101-601; 104 STAT. 3049)

This act assigns ownership or control of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony that are excavated or discovered on federal or tribal lands would be assigned to lineal descendants or culturally affiliated Native American groups. Criminal penalties are established for trafficking in remains or objects obtained in violation of the act. Federal agencies, and museums receiving federal funding, would inventory Native American human remains and associated funerary objects they hold; identify their cultural and geographical affiliations within five years; and prepare summaries of information about Native American unassociated objects.

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DESIGN GUIDELINES

Any construction of roads and associated facilities would be designed according to NPS *National Park Service Road Standards* (1984) and appropriate FHWA standards such as the 1985 *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects*, FP-92.

In conformance with applicable laws and regulations, specifically the Architectural Barriers Act of 1968 (PL 90-480), the Rehabilitation Act of 1973 (PL 93-112), and the 1984 *Uniform Federal Accessibility Standards* (49 CFR 31528), all facilities, including transportation vehicles, designed for public and employee use would be accessible to people with disabilities.

APPENDIX A: SPECIAL STATUS SPECIES LETTERS FROM U.S. FISH AND WILDLIFE SERVICE AND STATE OF ARIZONA DEPARTMENT OF GAME AND FISH

United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
(602) 640-2720 Fax(602) 640-2730

In Reply Refer To:
AESO/SE
2-21-97-I-004

October 8, 1996

Mr. Stephen Stone
Natural Resource Specialist
National Park Service
12795 W. Alameda Parkway, POB 25287
Denver, Colorado 25287

RE: Mather Point Transit Center Corridor, PT 15

Dear Mr. Stone:

This letter responds to your October 1996, request for a list of species which are listed as threatened, endangered, or are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may potentially occur in your project area (Coconino County). The enclosed list may include candidate species as well. In the past, the U.S. Fish and Wildlife Service has provided project-specific species lists and information. However, staff reductions no longer permit us to provide this detailed level of assistance. We regret any inconvenience this may cause you and hope the enclosed county list of species will be helpful. In future communications regarding this project, please refer to consultation number 2-21-97-I-004.

The enclosed list of the endangered, threatened, proposed, and candidate species includes all those potentially occurring anywhere in the county, or counties, where your project occurs. Please note that your project area may not necessarily include all or any of these species. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Also on the enclosed list is the Code of Federal Regulations (CFR) citation for each listed or proposed species. Additional information can be found in the CFR and is available at most public libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency must request formal consultation with the Service. If the action agency determines that the

planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency must enter into a section 7 conference with the Service. Candidate species are those which are being considered for addition to the list of threatened or endangered species. Candidate species are those for which there is sufficient information to support a proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, the Service recommends the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways or excavation in waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of tile Clean Water Act.

The State of Arizona protects some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species in your project area.

The Service appreciates your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please contact Tom Gatz.

Sincerely,

Sam F. Spiller
Field Supervisor

Enclosure

cc: Director, Arizona Game and Fish Department Phoenix, AZ

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino
3/21/96

LISTED .TOTAL= 17

NAME: **BRADY PINCUSHION CACTUS** *PEDIOCACTUS BRADYI*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 44 FR 61784, 10-26-1979

DESCRIPTION: SMALL, SEMI-GLOBOSE CACTUS, 2.4 INCHES TALL MID 2 INCHES IN DIAMETER. SPINES ARE WHITE OR YELLOWISH-TAN. THE SPINE CLUSTERS 1-2 CENTRAL SPINES & 14-15 SPREADING RADIAL SPINES. FLOWER: STRAW YELLOW PRODUCED AT TOP OF THE STEM

ELEVATION RANGE: 3850-4500 FT.

COUNTIES: COCONINO

HABITAT: BENCHES & TERRACES IN NAVAJO DESERT NEAR MARBLE GORGE

SUBSTRATE IS KAIBAB LIMESTONE CHIPS OVER MOENKOPI SHALE AND SANDSTONE SOIL. PLANT COMMUNITY DOMINATED BY SHADSCALE (ATRIPLEX CONFERTIFOLIA), SNAKEWEED (GUTEIERREZIA SAROTHRAE), MORMON TEA (EPHEDRA VIRIDIS), AND DESERT TRUMPET (ERIOGONUM INFLATUM). PROTECTED BY CITES AND ARIZONA NATIVE PLANT LAW.

NAME: **NAVAJO SEDGE** *CAREX SPECUICOLA*

STATUS: THREATENED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR:

DESCRIPTION: PERENNIAL FORB WITH TRIANGULAR STEMS, ELONGATED RHIZOMES. FLOWER: WHITE JUNE AND JULY

ELEVATION RANGE: 5700-6000 FT.

COUNTIES: COCONINO, NAVAJO, APACHE

HABITAT: SILTY SOILS AT SHADY SEEPS AND SPRINGS

DESIGNATED CRITICAL HABITAT IS ON THE NAVAJO NATION NEAR INSCRIPTION HOUSE RUINS. FOUND AT SEEP SPRINGS ON VERTICAL CLIFFS OF PINK-RED NAVAJO SANDSTONE

NAME: **SAN FRANCISCO PEAKS GROUNDSEL** *SENECIO FRANCISCANUS*

STATUS: THREATENED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR: 48 FR 52743, 11-22-1983

DESCRIPTION: MEMBER OF SUNFLOWER FAMILY, DWARF ALPINE SPECIES 1.2-4 INCHES TALL, LEAVES DEEPLY LOBED. FLOWERS: 0.5 INCH DIAMETER 1-6 YELLOW-GOLD FLOWERS.

ELEVATION RANGE: 10900+ FT.

COUNTIES: COCONINO

HABITAT: ALPINE TUNDRA

DESIGNATED CRITICAL HABITAT IS SAN FRANCISCO PEAKS. FOUND ABOVE SPRUCE-FIR AND PINE FORESTS ON TALUS SLOPES.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **SENTRY MILK-VETCH** *ASTRAGALUS CREMNOPHYLAX VAR CREMNOPHYLA*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: No CFR: 55 FR 50184, 12-5-1990

DESCRIPTION: < 1 INCH HIGH FORMING A MAT 1-10 INCHES IN DIAMETER. FLOWERS: PALE PURPLE APRIL TO MAY

ELEVATION RANGE: >4000FT.

COUNTIES: COCONINO

HABITAT: PINYON-JUNIPER-CLIFFROSE ON A WHITE LAYER OF LIMESTONE

GROWS ON KAIBAB LIMESTONE WITH LITTLE SOIL IN AN UNSHADED OPENING IN PINYON-JUNIPER. POSSIBLY MORE POPULATIONS TO BE FOUND ON SOUTH RIM OF GRAND CANYON AND EAST RIM OF MARBLE GORGE.

NAME: **SILER PINCUSHION CACTUS** *PEDIOCACTUS SILERI*

STATUS: THREATENED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 44 FR 61786, 11-26-1979

DESCRIPTION: SMALL SOLITARY OR CLUSTERED CACTUS GLOBOSE SHAPED ABOUT 5 INCHES TALL AND 3-4 INCHES IN DIAMETER. FLOWERS: YELLOW WITH MAROON VEINS

ELEVATION RANGE 2800-5400 FT.

COUNTIES: MOHAVE, COCONINO

HABITAT: DESERTSCRUB TRANSITIONAL AREAS OF NAVAJOAN, SAGEBRUSH AND MOHAVE DESERTS

GROWS ON GYPSIFEROUS CLAY AND SANDY SOILS OF MOENKOPI FORMATION.

NAME: **WELSHS MILKWEED** *ASCLEPIAS WELSHII*

STATUS: THREATENED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR: 52 FR 41435, 10-28-1987

DESCRIPTION: MILKWEED FAMILY (ASCLEPIADACEAE), RHIZOMATOUS, HERBACEOUS PERENNIAL, 10-40 INCHES TALL WITH LARGE OVAL LEAVES. FLOWERS: CREAM COLORED, ROSE TINGED IN CENTER.

ELEVATION RANGE: VARIES FT.

COUNTIES: COCONINO

HABITAT: OPEN STABILIZED DESERTSCRUB DUNES AND LEE SIDE OF ACTIVE DUNES

DESIGNATED CRITICAL HABITAT IS IN UTAH.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **KANAB AMBERSNAIL** *OXYLOMA HAYDENI KANABENSIS*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 57 FR 13657, 04-17-1992

DESCRIPTION: SMALL 14-19 MM (<0.7 INCH). LIGHT AMBER COLOR. SOMETIMES GRAYISH-AMBER MOTTLED; RIGHT HANDED SHELL

ELEVATION RANGE: 2,900 FT.

COUNTIES: COCONINO

HABITAT: TRAVERTINE SEEPS AND SPRINGS IN GRAND CANYON NATIONAL PARK

EXTREMELY GEOGRAPHICALLY ISOLATED. THREE HISTORIC POPULATIONS; TWO REMAINING; ONE ON PRIVATE PROPERTY IN UTAH AND ONE IN GRAND CANYON NATIONAL PARK; SPECIES AFFECTED BY OPERATIONS BY GLEN CANYON DAM. ASSOCIATED WITH WATERCRESS, MONKEY FLOWER AND OTHER WETLAND VEGETATION.

NAME: **BLACK-FOOTED FERRET** *MUSTELA NIGRIPES*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67

DESCRIPTION: WEASEL-LIKE, YELLOW BUFF COLORATION WITH BLACK FEET, TAIL TIP, AND EYE MASK. IT HAS A BLUNT LIGHT COLORED NOSE AND IS 15-18 INCHES LONG AND TAIL LENGTH IS 5-6 INCHES.

ELEVATION RANGE: <10,500 FT.

COUNTIES: COCONINO, APACHE, NAVAJO

HABITAT: GRASSLAND PLAINS GENERALLY FOUND IN ASSOCIATION WITH PRAIRIE DOGS

UNSURVEYED PRARIE DOG TOWNS MAY BE OCCUPIED BY FERRETS OR MAY BE APPROPRIATE FOR FUTURE REINTRODUCTION EFFORTS. THE SERVICE DEVELOPED GUIDELINES FOR SURVEYING PRAIRIE DOG TOWNS WHICH ARE AVAILABLE UPON REQUEST. NO POPULATIONS OF THIS SPECIES CURRENTLY KNOWN TO EXIST IN ARIZONA.

NAME: **HUALAPAI MEXICAN VOLE** *MICROTUS MEXICANUS HUALPAIENSIS*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 52 FR 36776,10-01-87

DESCRIPTION: SMALL, CINNAMON-BROWN MOUSE-SIZED WITH SHORT TAIL AND LONG FUR THAT NEARLY COVERS ITS SMALL ROUND EARS.

ELEVATION RANGE: 3500-7000 FT.

COUNTS: MOHAVE, COCONINO, YAVAPAI

HABITAT: GRASS/FORB HABITATS IN PONDEROSA PINE, TYPICALLY NEAR WATER. (CONTINUED BELOW)

ALSO FOUND IN PINYON-JUNIPER & PINE-OAK ASSOCIATIONS WITH A VARIETY OF SHRUBS AND GRASSES. DISTRIBUTION HAS GENERALLY BEEN CONSIDERED TO BE IN THE HUALAPAI MOUNTAIN RANGE AND POSSIBLY IN THE PROSPECT VALLEY AND MUSIC MOUNTAINS. ONGOING RESEARCH SUGGESTS THAT POPULATIONS MAY OCCUR IN THE HUALAPAI NATION, AUBREY CUFFS, CHINO WASH, SANTA MARIA MOUNTAINS, BRADSHAW MOUNTAINS, ROUND MOUNTAIN, AND SIERRA PRIETA MOUNTAINS. THE TAXON MAY ULTIMATELY BE RENAMED.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **HUMPBACK CHUB** *GILA CYPHA*

STATUS: ENDANGERED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-1967; 59 FR 13374, 03-21-1994

DESCRIPTION: LARGE (18 INCH) MINNOW FLATTENED HEAD LONG FLESHY SNOUT, LARGE FINS, AND A VERY LARGE HUMP BETWEEN THE HEAD AND THE DORSAL FIN

ELEVATION RANGE: <4000 FT.

COUNTIES: COCONINO, MOHAVE

HABITAT: LARGE WARM TURBID RIVERS ESPECIALLY CANYON AREAS WITH DEEP FAST WATER

CRITICAL HABITAT IN GRAND CANYON

NAME: **LITTLE COLORADO SPINEDACE** *LEPIDOMEDA VITTATA*

STATUS: THREATENED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR: 52 FR 35054

DESCRIPTION: SMALL (<4 INCHES LONG) SILVERY MINNOW WHICH IS DARKER ON THE BACK THAN THE BELLY

ELEVATION RANGE: 4000-8000 FT.

COUNTIES: COCONINO, APACHE, NAVAJO.

HABITAT: MODERATE TO SMALL STREAMS IN POOLS AND RIFFLES WITH WATER FLOWING OVER GRAVEL AND SILT

CRITICAL HABITAT INCLUDES EIGHTEEN MILES OF EAST CLEAR CREEK, EIGHT MILES OF CHEVELON CREEK, AND FIVE MILES OF NUTRIOSO CREEK

NAME: **RAZORBACK SUCKER** *XYRAUCHEN TEXANUS*

STATUS: ENDANGERED CRITICAL HABITAT: Yes RECOVERY PLAN: No CFR: 55 FR 21154, 05-22-1990; 59 FR 13374, 03-21-1994

DESCRIPTION: LARGE (UP TO 3 FEET AND UP TO 16 POUNDS) LONG, HIGH SHARP-EDGED KEEL-LIKE HUMP BEHIND THE HEAD. HEAD FLATTENED ON TOP. OLIVE-BROWN ABOVE TO YELLOWISH BELOW.

ELEVATION RANGE: <6000 FT.

COUNTIES: GREENLEE, MOHAVE, PINAL, YAVAPAI, YUMA, LA PAZ, MARICOPA (REFUGIA), GILA, COCONINO, GRAHAM

HABITAT: RIVERINE & LACUSTRINE AREAS. GENERALLY NOT IN FAST MOVING WATER AND MAY USE BACKWATERS

SPECIES IS ALSO FOUND IN HORSESHOE RESERVOIR (MARICOPA COUNTY).

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **AMERICAN PEREGRINE FALCON** *FALCO PEREGRINUS ANATUM*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 35 FR 16047, 10-13-70; 35 FR 8495, 06-02-70

DESCRIPTION: A RECLUSIVE, CROW-SIZED FALCON SLATY BLUE ABOVE WHITISH BELOW WITH FINE DARK BARRING. THE HEAD IS BLACK AND APPEARS TO BE MASKED OR HELMETED. WINGS LONG AND POINTED. LOUD WAILING CALLS ARE GIVEN DURING BREEDING PERIOD.

ELEVATION RANGE: 3500-9000 FT.

COUNTIES: MOHAVE, COCONINO, NAVAJO, APACHE, SANTA CRUZ, MARICOPA, COCHISE, YAVAPAI, GALA, PINAL, PIMA, GREENLEE, GRAHAM

HABITAT: CUFFS AND STEEP TERRAIN USUALLY NEAR WATER OR WOODLANDS WITH ABUNDANT PREY

THIS IS A WIDE-RANGING MIGRATORY BIRD THAT USES A VARIETY OF HABITATS. BREEDING BIRDS ARE YEAR ROUND RESIDENTS. OTHER BIRDS WINTER AND MIGRATE THROUGH ARIZONA. SPECIES IS ENDANGERED FROM REPRODUCTIVE FAILURE FROM PESTICIDES.

NAME: **BALD EAGLE** *HALIAEETUS LEUCOCEPHALUS*

STATUS: THREATENED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 60 FR 35999, 07-12-95

DESCRIPTION: LARGE, ADULTS HAVE WHITE HEAD AND TAIL HEIGHT 28 – 38"; WINGSPAN 66 – 96". 1-4 YRS DARK WITH VARYING DEGREES OF MOTTLED BROWN PLUMAGE. FEET BARE OF FEATHERS.

ELEVATION RANGE: VARIES FT.

COUNTIES: YUMA, LA PAZ, MOHAVE, YAVAPAI, MARICOPA, PINAL, COCONINO, NAVAJO, APACHE, SANTA CRUZ, PIMA, GILA, GRAHAM

HABITAT: LARGE TREES OR CUFFS NEAR WATER (RESERVOIRS, RIVERS AND STREAMS) WITH ABUNDANT PREY

SOME BIRDS ARE NESTING RESIDENTS WHILE A LARGER NUMBER WINTERS ALONG RIVERS AND RESERVOIRS. AN ESTIMATED 200 TO 300 BIRDS WINTER IN ARIZONA. ONCE ENDANGERED (32 FR 4001, 03-11-1967; 43 FR 6233, 02-14-78) BECAUSE OF REPRODUCTIVE FAILURES FROM PESTICIDE POISONING AND LOSS OF HABITAT, THIS SPECIES WAS DOWN LISTED TO THREATENED ON AUGUST 11, 1995. ILLEGAL SHOOTING, DISTURBANCE, LOSS OF HABITAT CONTINUES TO BE A PROBLEM.

NAME: **CALIFORNIA CONDOR** *GYMNOPS CALIFORNIANUS*

STATUS: ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67

DESCRIPTION: VERY LARGE VULTURE (55 INCHES HEAD TO TAIL, WING=34, TAIL=16, TARSUS=4.25). HEAD AND UPPER PARTS OF NECK BARE, BILL YELLOW, CERE, HEAD AND NECK YELLOWISH-RED, PLUMAGE GREY-BLACK

ELEVATION RANGE: VARIES FT.

COUNTIES: MOHAVE, COCONINO, NAVAJO, COCHISE

HABITAT: HIGH DESERT CANYONLANDS, AND PLATEAUS

RECOVERY/REINTRODUCTION PROGRAM CURRENTLY EVALUATING THE FEASIBILITY OF REINTRODUCTION INTO ARIZONA BY 1996. NO LONGER OCCURS IN ARIZONA.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **MEXICAN SPOTTED OWL** *STRIX OCCIDENTALIS LUCIDA*

STATUS: THREATENED CRITICAL HABITAT: Yes RECOVERY PLAN: Yes CFR: 56 FR 14678, 04-11-91

DESCRIPTION: MEDIUM SIZED WITH DARK EYES AND NO EAR TUFTS. BROWNISH AND HEAVILY SPOTTED WITH WHITE OR BEIGE.

ELEVATION RANGE: 4100-9000 FT.

COUNTIES: MOHAVE, COCONINO, NAVAJO, APACHE, YAVAPAI, GRAHAM, GREENLEE, COCHISE, SANTA CRUZ, PIMA, PINAL, GILA, MARICOPA

HABITAT: NESTS IN CANYONS AND DENSE FORESTS WITH MULTI-LAYERED FOLIAGE STRUCTURE

GENERALLY NESTS IN OLDER FORESTS OF MIXED CONIFER OR PONDERSA PINE/GAMBEL OAK TYPE. IN CANYONS, AND USE VARIETY OF HABITATS FOR FORAGING. SITES WITH COOL MICROCLIMATES APPEAR TO BE OF IMPORTANCE OR ARE PREFERED.

NAME: **SOUTHWESTERN WILLOW FLYCATCHER** *EMPIDONAX TRAILLII EXTIMUS*

STATUS: ENDANGERED CRITICAL HABITAT: Yes RECOVERY PLAN: No CFR: 60 FR 10694, 02-27-95

DESCRIPTION: SMALL PASSERINE (ABOUT 6") GRAYISH-GREEN BACK AND WINGS. WHITISH THROAT. LIGHT OLIVE-GRAY BREAST AND PALE YELLOWISH BELLY. TWO WINGBARS VISIBLE. EYE-RING FAINT OR ABSENT.

ELEVATION RANGE <8500 FT.

COUNTIES: YAVAPAI, GILA, MARICOPA, MOHAVE, COCONINO, NAVAJO, APACHE, PINAL, LA PAZ, GREENLEE, GRAHAM, YUMA, PIMA, COCHISE, SANTA CRUZ

HABITAT: COTTONWOOD/WILLOW & TAMARISK VEGETATION COMMUNITIES ALONG RIVERS & STREAMS

MIGRATORY RIPARIAN OBLIGATE SPECIES THAT OCCUPIES BREEDING HABITAT FROM LATE APRIL TO SEPTEMBER. DISTRIBUTION WITHIN ITS RANGE IS RESTRICTED TO RIPARIAN CORRIDORS. DIFFICULT TO DISTINGUISH FROM OTHER MEMBERS OF THE EMPIDONAX COMPLEX BY SIGHT ALONE. TRAINING SEMINAR REQUIRED FOR THOSE CONDUCTING FLYCATCHER SURVEYS.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

PROPOSED TOTAL= 1

NAME: **PARISH ALKALI GRASS** P*UCCINELLIA PARISHII*

STATUS: PROPOSED ENDANGERED CRITICAL HABITAT: No RECOVERY PLAN: No CFR:

DESCRIPTION: A SMALL, BLUE-GREEN, ANNUAL GRASS. FLOWERING STEMS 1-8 INCHES TALL

ELEVATION RANGE: 3000-6000 FT.

COUNTIES: COCONINO, NAVAJO

HABITAT: MOIST SALINE SOILS

POTENTIALLY ANY SALINE SEEPS AND ASSOCIATED WETLANDS IN ARIZONA.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

CANDIDATE TOTAL= 5

NAME: **ARIZONA BUGBANE** *CIMICIFUGA ARIZONICA*

STATUS: CANDIDATE CRITICAL HABITAT: No RECOVERY PLAN: No CFR:

DESCRIPTION: PERENNIAL HERB IN THE BUTTERCUP FAMILY UP TO 6-7 FEET TALL. SMALL WHITE PETAL-LESS FLOWERS APPEAR IN JULY-AUGUST. FRUIT A FOLLICLE THAT SPLITS OPEN ON ONE SIDE AS IT DRIES.

ELEVATION RANGE: 5300-7000 FT.

COUNTIES: COCONINO, GALA

HABITAT: MOIST, LOAMY SOIL BETWEEN CONIFEROUS AND RIPARIAN ECOTONES.

RICH, FERTILE SOILS HIGH IN HUMUS CONTENT, DEEP SHADE, AND HIGH HUMIDITY APPEARS TO BE PRIMARY HABITAT REQUIREMENTS FOR THIS SPECIES.

NAME: **ARIZONA LEATHER FLOWER** *CLEMATIS HIRSUTISSIMA ARIZONICA*

STATUS: CANDIDATE CRITICAL HABITAT: No RECOVERY PLAN: No CFR:

DESCRIPTION: A PERENNIAL IN THE BUTTERCUP FAMILY FROM 8-23 INCHES TALL. BLOOMS BEFORE SUMMER RAINS FLOWER: A PURPLISH SEPALS FRUIT BEARS LONG PLUMSE "TAIL".

ELEVATION RANGE 6800-6900 FT.

COUNTIES: COCONINO, APACHE

HABITAT: KAIBAB LIMESTONE SOILS IN SMALL COLONIES. REQUIRES SHADE FROM PONDEROSA OR PINYON PINE STANDS

ENTIRE ELEVATION RANGE IS NOT YET UNDERSTOOD.

NAME: **FICKEISEN PINCUSHION CACTUS** *PEDIOCACTUS PEEBLESIANUS FICKEISENIAE*

STATUS: CANDIDATE CRITICAL HABITAT: No RECOVERY PLAN: No CFR:

DESCRIPTION: VERY SMALL (3 INCHES TALL-1.5 INCHES DIAMETER) UNBRANCHED CACTUS THAT RETREATS INTO GRAVELY SOILS AFTER FLOWERING AND FRUITING. TUBERCLES FORM A SPIRAL PATTERN AROUND PLANT. CENTRAL SPINE 3/8 INCH LONG FLOWERS CREAM/YELLOW

ELEVATION RANGE: 4000-5000 FT.

COUNTIES: COCONINO, MOHAVE

HABITAT: EXPOSED LAYERS OF KAIBAB LIMESTONE ON CANYON MARGINS OR HILLS OF NAVAJOAN DESERT

LISTED. PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: Coconino

3/21/96

NAME: **KAIBAB PLAINS CACTUS** *PEDIOCACTUS PARADINEI*

STATUS: CANDIDATE CRITICAL HABITAT: No RECOVERY PLAN: No CFR:

DESCRIPTION: SMALL (1-2 INCHES TALL AND 1-2 INCHES WIDE) CACTUS. 4-6 CENTRAL SPINES HAIR-LIKE, DENSE, WHITE TO PALE GRAY NOT DISTINGUISHABLE FROM RADIAL SPINES. FLOWER: WHITE OR PINK 1 INCH WIDE

ELEVATION RANGE: 5000-7000 FT.

COUNTIES: COCONINO

HABITAT: PINYON-JUNIPER WOODLAND OR SAGEBRUSH VALLEYS ON KAIBAB LIMESTONE GRAVELS

NAME: **CHIRICAHUA LEOPARD FROG** *RANA CHIRICAHUENSIS*

STATUS: CANDIDATE CRITICAL HABITAT: No RECOVERY PLAN: No CFR: 59 FR 58996

DESCRIPTION: CREAM COLORED TUBERCULES (spots) ON A DARK BACKGROUND ON THE REAR OF THE THIGH, DORSOLATERAL FOLDS THAT ARE INTERRUPTED AND DEFLECTED MEDIALLY, AND A CALL GIVEN OUT OF WATER DISTINGUISH THIS SPOTTED FROG FROM OTHER LEOPRD

ELEVATION RANGE: 3000-8300 FT.

COUNTIES: SANTA CRUZ, APACHE, GALA, PIMA, COCHISE, GREENLEE, GRAHAM, YAVAPAI, COCONINO, NAVAJO

HABITAT: STREAMS, RIVERS, BACKWATERS, PONDS, AND STOCK TANKS THAT ARE FREE FROM INTRODUCED FISH AND BULLFROGS

REQUIRE PERMANENT OR NEARLY PERMANENT WATER SOURCES. POPULATIONS NORTH OF THE GALA RIVER ARE THOUGHT TO BE CLOSELY-RELATED, BUT DISTINCT, UNDESCRIBED SPECIES.

THE STATE OF ARIZONA

Governor
Fife Symington

Commissioners:
Chairman. Nonie Johnson. Snowflake
Michael M. Golightly. Flagstaff
Herb Guenther. Tacna
Fred Belman. Tucson
M. Jean Hassell, Scottsdale

GAME & FISH DEPARTMENT
2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000

Director
Duane L. Shroute

Deputy Director
Thomas W. Spalding

October 30, 1996

Mr. Stephen E. Stone
National Park Service, Denver Service Center
P.O. Box 25287
Denver, Colorado 80225-0287

Re: Special Status Species; Proposed Construction Project from Tusayan to Mather Point, Grand Canyon National Park

Dear Mr. Stone:

The Arizona Game and Fish Department (Department) has reviewed your letter, dated October 1, 1996, regarding special status species in the vicinity of the above-referenced area, and the following information is provided.

The Department's Heritage Data Management System has been accessed and current records show that the special status species listed below have been documented as occurring in project-vicinity.

T31N, R3E, Sec 19, 30; T31N, R2E, Sec 25, 36; T30N, R2E, Sec 1, 12, 13, 23.

COMMON NAME	SCIENTIFIC NAME	STATUS
Arizona leather flower	Clematis hirsutissima arizonica	C, S, HS
Bigelow onion	Allium bigelovii	SR
Grand Canyon catchfly	Silene rectiramea	S
Humpback chub	Gila cypha	LE, WC, S
Mexican spotted owl	Strix occidentalis lucida	LT, WC, S
Northern goshawk	Accipiter gentilis	WC, S
peregrine falcon	Falco peregrinus anatum	LE, WC, S
sentry milk-vetch	Astragalus cremnophylax cremnophylax	LE, S, HS
Tusayan flame flower	Talinum validulum	S, SR
Western red bat	Lasiurus blossevillii	WC, S

STATUS DEFINITIONS

LE - Listed Endangered. Species identified by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) as being in imminent jeopardy of extinction.

LT - **Listed Threatened.** Species identified by USFWS under ESA as being in imminent jeopardy of becoming Endangered.

C - **Candidate.** Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.

WC - **Wildlife of Special Concern in Arizona.** Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep.). Species included in WSCA are currently the same as those in Threatened Native Wildlife in Arizona (1988).

S - **Sensitive.** Species classified as "sensitive" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

HS - **Highly Safeguarded.** Those Arizona native plants whose prospects for survival in this state are in jeopardy or are in danger of extinction, or are likely to become so in the foreseeable future, as described by the Arizona Native Plant Law (1993).

SR - **Salvage Restricted.** Those Arizona native plants not included in the Highly Safeguarded Category, but that have a high potential for theft or vandalism, as described by the Arizona Native Plant Law (1993).

At this time, the Department's comments are limited to the special status species information provided above. This correspondence does not represent the Department's evaluation of impacts to wildlife or wildlife habitat associated with this project. The Department would appreciate the opportunity to provide such an evaluation when specific actions become available.

Thank you for the opportunity to comment on this project. If you have any questions, please contact me at (602) 789-3606.

Sincerely,

Nancy Olson
Project Evaluation Specialist
Habitat Branch

NLO: no

cc: Tom Britt, Regional Supervisor, Region II, Flagstaff

AGFD# 10-08-96(13)

APPENDIX B: SUMMARY OF SPACES AND SIZES FOR THE MATHER POINT ORIENTATION AND TRANSIT CENTER

It is assumed that 25% of the 4,993 Tusayan transit visitors and 3,906 tour bus passengers (126 buses/hr x 31 passengers/bus) and 330 lodging guests (250 vehicles x 3.3 persons/vehicle x 40% accumulation rate) arriving on the village shuttle, would choose to forego an interior lobby/orientation or interpretive exhibit space they are repeat visitors, shortness of time, or lack of interest. This results in a year 2010 summer design day peak hour visitation rate of **6,922** people arriving in the Mather Point Center and moving through the exterior and interior orientation exhibit/lobby spaces. The interior interpretive exhibit space is sized based on the year 2010 winter design day peak hour visitation rate of **1,544** people to provide sufficient protected, enclosed space during the winter months. The interior and exterior interpretive exhibit spaces would relate strongly to each other. The time spent on the interior exhibits is based on 6,922 visitors occupying 3,602 sq. ft. It is assumed that the orientation exhibit spaces would require 6 sq.ft./person and the interpretive exhibit space would require 7 sq. ft./person.

	Square Feet
Transportation Center (Exterior Transit System Orientation)	3,000
Exterior Orientation Exhibit Space (5 min)	3,461
Exterior Interpretive Exhibit Space (6 min)	4,845
Lobby/Interior Orientation Exhibits (10 min)	6,922
Interior Interpretive Exhibit Space (4.46 min)	3,602
Vestibule/Air Lock	120
NPS Information Counter	150
Fred Harvey Information Counter	150
Fred Harvey Office Space	150
Office Space (Orientation Center Manager	150
Office/Work Space (Interpreters - open work space)	600
Employee Conference/Training room	400
General Storage Room	200
Staff Restrooms (2 rooms)	150
Office/Storage Space for 2 maintenance staff	250
First-Aid Room (bed, toilet, and lavatory)	150
Circulation for Office Spaces (20% of offices)	350
Public Restrooms I (W: 22 t, 61, M: 6 t, 9 u, 61)	1,700
Public Restrooms II (W: 22 t, 51, M: 5 t, 8 u, 51)	1,700
GCA Sales Area (incl. remit, office, short term storage)	3,000
Bicycle Rental Area	1,000
Structure and Walls, 7% of above	1,452
Mechanical/Electrical Space, 5.5% of above	1,141
INTERIOR SPACE TOTAL	**23,337**
EXTERIOR SPACE TOTAL	**11,306**

APPENDIX C: SHUTTLE BUS SERVICE COMMON TO ALL ALTERNATIVES

Prepared by B. Traver - 1/3/97

This paper outlines the bus service that will provided regardless of which alternative is selected in the environmental assessment. The cost of providing this service will need to be included in the overall cost of providing a transportation service on the South Rim and will be recovered by a fee charged to all park visitors. Service from West Rim Interchange to Hermit's Rest and from Mather Point to Yaki Point is included.

1. Ridership Projections

The following are estimates of ridership for the two routes in question:

West Rim

2000 Summer	800 rides per hour
2000 Shoulder	560 rides per hour
2000 Winter	265 rides per hour
2010 Summer	1,000 rides per hour
2010 Shoulder	672 rides per hour
2010 Winter	318 rides per hour

Yaki Point

2000 Summer	75 rides per hour*
2000 Shoulder	75 rides per hour
2000 Winter	35 rides per hour
2010 Summer	75 rides per hour
2010 Shoulder	75 rides per hour
2010 Winter	42 rides per hour

* Note that demand may be higher but capacity constraints at that overlook govern service provided.

2. Route Descriptions

The West Rim Route will begin at the West Rim Interchange and stop at seven overlooks on its way to Hermit's Rest where it will also stop. The return trip will stop only at Mohave Point. The round trip travel time is estimated at 45 minutes and the route is 16 miles long.

The Yaki Point Route starts at the Mather Point Transit Center and stops at the South Kaibab trailhead and at Yaki Point before returning to Mather Point. The round-trip travel time is estimated at 20 minutes and the route is approximately 4 miles long.

3. Transit Vehicle Requirements

The same 45-foot-long buses used in the bus alternative would be used for the West Rim Loop, assuming the existing fleet is replaced. Some savings can be realized by using existing fleet buses provided at no cost, but, for the purposes of this environmental assessment, it is assumed that all equipment will be new. The buses would be LNG/battery powered with future conversion to fuel cell power planned.

The Yaki Point route would be served by the electric buses currently being added to the park's fleet. These will be government-owned buses provided to the contractor at no cost. The buses are 25-person capacity, battery powered buses.

4. Fleet Requirements

The fleet requirements are listed below:

West Rim

2000 Summer - 15 buses + 3 spares = 18 buses
6-minute headways

2000 Shoulder -11 buses + 2 spares = 13 buses
8-minute headways

2000 Winter - 5 buses + 1 spare = 6 buses
12-minute headways

2010 Summer - 19 buses + 3 spares = 21 buses
4.7-minute headways

2010 Shoulder -13 buses + 2 spares = 15 buses
7-minute headways

2010 Winter - 6 buses + 1 spare = 7 buses
15-minute headways

Yaki Point
This route can always be served by one active bus and one spare. Headways would be 20 minutes.

5. Transit Service Requirements

Transit service will operate along the following schedule:

West Rim

Summer	6 A.M. to 10 P.M.
Shoulder	7 A.M. to 9 P.M.
Winter	7 A.M. to 8 P.m.

Yaki Point

Summer	4 A.M. to 10 P.M.
Shoulder	5 A.M. to 10 P.M.
Winter	7 A.M. to 8 P.M.

6. Personnel Requirements

The personnel requirements, based on 2.5 employees per active bus, are listed below:

West Rim

2000 Summer	38 employees
2000 Shoulder	28 employees
2000 Winter	13 employees
2010 Summer	48 employees
2010 Shoulder	33 employees
2010 Winter	15 employees

Yaki Point
A total of 3 employees would be required to support this route.

7. Capital Cost Estimate

There will be no capital costs associated with the Yaki Point route. A bus barn and charging stations for each bus will be available to the contractor. Capital costs for the West Rim route are as follows:

Rolling Stock
2000 -18 buses @ $350,000 ea. = $6.3 million.
2010 - 21 buses @ $350,000 ea. = $7.35 million.

Maintenance Facility
As per the Tusayan to Mather Point route in the bus alternative, three maintenance bays will be needed. Additionally, another bay for vehicle cleaning and washing will be needed. Each bay should be figured at 3,000 square feet, including tool and part storage and equipment space. The entire facility should then be (4 x 3,000 sf) 12,000 square feet. Capital costs are estimated at $150/sf. The maintenance facility is estimated to cost (12,000 sf x $150/sf) $1.8 million.

A maintenance yard will also be necessary. It will be exactly the same size as the yard needed for the Tusayan to Mather Point route and is estimated at $50,000.

A bus barn will be necessary, again, exactly the same size as that required for the Tusayan to Mather route. It is estimated at $273,000.

LNG Fueling Facility
A fueling facility will be available to the contractor at no capital cost.

Fuel Cell Conversion
These capital costs would be the same as for the Tusayan to Mather Route and are

estimated at $6.3 million for the full 2010 fleet.

West Rim Drive Reconstruction
The condition of West Rim Drive is not suitable for heavy bus traffic and will need to be improved. The road is 8 miles long and, at $1.0 million per mile, reconstruction is estimated at $8.0 million.

Capital Cost Summary

Rolling Stock	$ 7,350,000
Maintenance Building	1,800,000
Maintenance Yard	50,000
Bus Barn	273,000
Fuel Cell Conversion	6,300,000
West Rim Drive Rehab	8,000,000
Total Capital Costs	$23,773,000

8. Operation and Maintenance Costs

Miles driven per day on each route are listed seasonally below:

	West Rim	Yaki Point
2000 Summer	2573	216
2000 Shoulder	1643	204
2000 Winter	587	132
2010 Summer	3243	216
2010 Shoulder	1941	204
2010 Winter	704	132

O&M costs are estimated at $3.50 per mile for 2000 and $4.00 per mile for 2010. Therefore, annual O&M costs would be $2.05 million in 2000 for the West Rim route and $2.85 million for that route in 2010. O&M costs would be $0.24 million for the Yaki Point route in 2000 and $0.28 in 2010. Total O&M costs would be $2.29 million in 2000 and $3.13 million in 2010.

9. Cost Per Visitor

The following would be the cost per visitor to operate this portion of the transportation system:

Year 2000

Annual O&M Cost	$2.29 million
Annual Capital Cost	$2.42 million
Total Annual Cost	$4.71 million
Projected Visitation	5,182,384
Cost Per Visitor	$0.91

Year 2010

Annual O&M Cost	$3.13 million
Annual Capital Cost	$2.42 million
Total Annual Cost	$5.55 million
Projected Visitation	$6,865,000
Cost Per Visitor	$0.81

ADDENDUM
to the
TRANSIT SYSTEM COST ESTIMATE
To include Mather Point to Grand Canyon Village Service

This addendum is intended to add additional bus routes to alternative B being considered in the environmental assessment for Mather Point. This is necessary to provide a similar service to that being evaluated in the rail alternative.

1. Ridership Projections

Visitation assumptions are unchanged from the 12/31/96 document. Projected ridership is estimated at 2,800 riders per hour between Mather Point and Grand Canyon Village during peak times in 2010. Since the projected peak ridership is so similar to the Tusayan to Mather Point route, the remaining figures from table 1 of the 12/31/96 document can be assumed to apply to the Mather Point to Grand Canyon Village service as well.

2. Mather Point to Grand Canyon Village Service

There will be two routes providing this service -one a "local" and another an "express."

The local route will start at the Mather Point Transit Center and stop at Yavapai Lodge/Business Center, Shrine of the Ages, Trailer Village, and Mather Campground before continuing to the Historic Village and stopping at Bright Angel Lodge, West Rim Interchange, Maswik Transportation Center, and the Heritage Education Campus (a bus stop now referred to as Center Road). The round-trip travel time is estimated at 1 hour.

The express route will start at the Mather Point Transit Center and stop only at the Historic Village stops - Bright Angel Lodge, West Rim Interchange, Maswik Transportation Center, and the Heritage Education Campus. Round-trip travel time is estimated at 24 minutes.

3. Transit Vehicle Requirements

The transit vehicles for both routes will be the same as the vehicles used for the Tusayan to Mather Point route - 45-foot-long buses. The local route will have a capacity of about 50 (40 seated) while the express will be the same 80 person capacity with perimeter seating only. All vehicles will be powered by hybrid LNG generator/battery power systems, ready for conversion to fuel cell power in the future.

4. Fleet Requirements

The express route, which is estimated to carry approximately 70% of the demand, will require 9 buses, including 1 spare by 2010. It will run on about 2.5 minute headways.

The local route, which is estimated to carry the other 30% of the demand, will require 20 buses, including 3 spares by 2010. It will run on about 3-minute headways.

5. Transit Service Requirements

The express route will operate the same schedule as the Tusayan to Mather Point route except at night when this route will be dropped entirely.

The local route will operate the same schedule as the Tusayan to Mather Point route, including hourly service with a single bus overnight.

6. Personnel Requirements

Using the ratio of 2.5 employees per active bus in the fleet, an additional 63 employees will be required for peak season operation in 2010. For shoulder and winter season operation, 45 and 23 employees would be needed, respectively, in 2010. For 2000, the figures would be 53 summer, 38 shoulder, and 19 winter.

7. Capital Cost Estimates

Rolling Stock
Using the same buses as specified in the 12/31/96 document, purchase of another 29 buses would cost approximately $10.2 million. About 24 of the 29 buses ($8.4 million) would be needed to begin operation in 2000.

Maintenance Facility
Three more bays would need to be added to the maintenance facility at 3,000 sf each (including space for tools, equipment, and parts). 9,000 sf at $150/sf is an additional $1.35 million. The maintenance yard would need to be expanded by 1/3 acre at a cost of approximately $67,000. The addition to the bus barn would be 18,850 sf and would cost approximately $377,000.

Fuel Cell Conversion
Converting the 29 buses to fuel cell power would cost approximately $8.7 million. For both this and the conversion of the first 21 buses, federal assistance will be requested but the extent of the assistance available is unknown.

Capital Cost Summary

Rolling Stock	$10,200,000
Maintenance Building	1,350,000
Maintenance Yard	67,000
Bus Barn	377,000
Fuel Cell Conversion	8,700,000
Total	$20,694,000

8. Operation and Maintenance Costs

The local bus would travel approximately 5 miles each round trip. The express bus approximately 4 miles. The miles driven per day per season are shown below.

	Local	Express
2000 Summer	1020	960
2000 Shoulder	654	616
2000 Winter	221	208
2010 Summer	1224	1152
2010 Shoulder	785	739
2010 Winter	265	250

O & M costs for 2000, based on the mileage above, would be approximately $1.58 million using a figure of $3.50 per mile for average operating costs. For 2010, the O & M costs would be approximately $2.16 million, using a figure of $4.00 per mile for average operating costs.

9. Costs Per Visitor

The additional fee per visitor for the Mather Point to Grand Canyon Village service would be as follows:

Year 2000

Annual O&M Cost	$1.58 million
Annual Capital Cost	$2.11 million
Total Annual Cost	$3.69 million
Projected Visitation	5,182,384
Cost Per Visitor	$0.71

Year 2010		Projected Visitation	6,865,000
Annual O&M Cost	$2.16 million		
Annual Capital Cost	$2.11 million	Cost Per Visitor	$0.62
Total Annual Cost	$4.27 million		

APPENDIX D: PECCIA ASSOCIATES REPORT, 1996
(1997 REVISION)

DESIGN PARAMETERS - ALTERNATIVE A
TUSAYAN-MATHER POINT TRANSIT SYSTEM
GRAND CANYON NATIONAL PARK, ARIZONA

This document is intended to provide the members of the Grand Canyon GMP Implementation Team with updated information relating to the design parameters related to the development of Alternative A for a visitor transit system between Tusayan, AZ and Mather Point within the Park. Alternative A consists of two parking areas, one in Tusayan and one at Mather Point and a transit bus service connecting the two parking areas. In this alternative a limited number of private vehicles would be permitted to park in the Mather Parking area. The transit service will operate for nine months per year (March-November).

1. Visitor and Vehicle Projections

Design Day Calculations

Assumptions used in Design Day calculations:

1994 Total Visitation = 4,172,814
2000 Total Visitation = 5,182,384
2010 Total Visitation = 6,865,000

1994 South Rim Visitation = 3,751,014
2000 South Rim Visitation = 4,722,259
2010 South Rim Visitation = 6,341,000

Modal Split

For the purposes of this analysis the mode splits for the year 2000 are estimated to be 75% by car, 8.4% by shuttle bus, 13.6% by tour bus, and 3% by train. In the 2010 design year the modal splits are 72.7% by car, 9.3% by shuttle bus, 15% by tour bus and 3% by train.

YEAR 2000 - South Rim

Summer Design Day 2000 = 37,554 visitors
75% private veh. = 28,166 vis. by private veh./ 3.3 PPV = 8,535 veh. (8,180 cars & 355 RV's)
8.4% Shuttle Bus = 3,155 vis. by shuttle bus/ 31 PPV = 102 shuttle buses
13.6% Tour Bus = 5,107 vis. by tour bus/ 31 PPV = 165 tour buses
3% Train = 1,127 vis. by train

Winter Design Day 2000 = 12.855 visitors
75% private veh. = 9,641 vis. by private veh./ 2.6 PPV = 3,708 veh. (3,542 cars & 166 RV's)
8.4% Shuttle Bus = 1,080 vis. by shuttle bus/ 31 PPV = 35 shuttle buses
13.6% Tour Bus = 1,748 vis. by tour bus/ 31 PPV = 56 tour buses
3% Train = 386 vis. by train

YEAR 2010 - South Rim

Summer Design Day 2010 = 45.000 visitors
72.7% private veh. = 32,715 vis. by private veh./ 3.3 PPV = 9,914 veh. (9,502 cars & 412 RV's)
9.3% Shuttle Bus = 4,185 vis. by shuttle bus/ 31 PPV = 135 shuttle buses
15% Tour Bus = 6,750 vis. by tour bus/ 31 PPV = 218 tour buses

3% Train = 1,350 vis. by train

Winter Design Day 2010 = 15.404 visitors
72.7% private veh. = 11,199 vis. by private veh./ 2.6 PPV = 4,307 veh. (4,130 cars & 177 RV's)
9.3% Shuttle Bus = 1,433 vis. by shuttle bus/ 31 PPV = 46 shuttle buses
15% Tour Bus = 2,311 vis. by tour bus/ 31 PPV = 75 tour buses
3% Train = 462 vis. by train

2. Parking Requirements

Mather Point Parking Area
Mather Point should be sized to accommodate the peak winter demand in 2010. Based in calculations contained in a tech memo dated 5/21/96 the Mather parking area would be sized to accommodate 841 cars, 42 RVs, and 90 buses. Using 300 sf per car and 1000sf per bus and RV, the parking area would have a 8.8 acre paved surface.

Tusayan Parking Area
The parking area at Tusayan should be sized to accommodate the peak summer parking demand in the year 2010. The parking area calculation contained in the 5/21/96 tech memo indicates that the Tusayan parking area should be size to accommodate 2,316 cars, 106 RV's, and 32 buses. This parking lot will have 19.1 acres of paved area.

3. Transit System Requirements

The Tusayan-Mather transit system will operate between two transit terminals, one at Mather Point and the other located north of the IMAX theater at the north end of Tusayan. It is assumed that the round-trip route is approximately 12 miles in length and the average operating speed of the vehicles is 30 MPH. Stops for loading and unloading will only occur at the two terminals and are estimated to take three minutes per stop. This yields a round-trip travel time of 30 minutes including the stops. If 80 passenger vehicles were used each vehicle would be able to move 160 passengers one-way per hour.

The transit system is sized to accommodate the peak hourly load. A peak hour factor of 13% of the daily demand was used. The 80% distribution factor was used the same as in the parking calculation. The 11 non-visitor factor has to be modified based on a lowed vehicle occupancy in the non-visitor vehicles. For the purposes of the transit calculation a vehicle occupancy rate of 1.1 PPV was assumed. Therefore the 11 % becomes the equivalent of 3.7%. A total of 971 visitors using the Mather parking area (([841+42] x 3.3)/3) were subtracted from the transit demand to account for the hourly demand reduction caused by the parking area. A total of 150 overnight guests were also subtracted from the transit demand.

For the purposes of this document the fleet size is based on using a standard 45 foot-long transit buses that have a capacity of 80 passengers (seated and standing). In the GMT a value of 100 passengers per vehicle was used. We are finding that although 100 passenger vehicles are made, it would be prudent to use a value of 80 since significantly more manufacturers offer vehicles in the 80-passenger range versus 100-passengers.

The shoulder season demand was estimated to be 70% of the summer demand value.

2000 Summer
Summer Design Day = 28,166 visitors by car
Max. Transit demand =[(28,166 x 96.3% x 80% x 13%) - 971- (150 x 3.3)] = 1,355 rides/hr
Route Requirements = 1.355/ 160 = 9 buses
Vehicle Headway = 60/ 18 = 3.3 minutes
Fleet Requirements = 9 buses + 2 spares =**11 buses**

2000 Shoulder
Shoulder Design Day = 19,716 visitors by car
Max. Transit demand = [(19,716 x 96.3% x 80% x 13%) - 971 - (150 x 2.6)] = 614 rides/hr
Route Requirements = 614/ 160 = 4 buses
Vehicle Headway = 60/8 = 7.5 minutes
Fleet Requirements = 4 buses + 1 spare = **5 buses**

2010 Summer
Summer Design Day = 32,715 visitors by car
Max. Transit demand = [(32,715 x 96.3% x 80% x .13%) - 971 - (150 x 3.3)] = 1,810 rides/hr
Route Requirements = 1,810/160 = 12 buses
Vehicle Headway = 60/24 = 2.5 minutes
Fleet Requirements = 12 buses + 2 spares =**14 buses**

2010 Shoulder
Shoulder Design Day = 22,901 visitors by car
Max. Transit demand = [(22,901 x 96.3% x 80% x 13%) - 971 - (150 x 2.6)] = 933 rides/hr
Route Requirements = 933/ 160 = 6 buses
Vehicle Headway = 60/12 = 5 minutes
Fleet Requirements = 6 buses + 1 spare = **7 buses**

4. Transit Service Requirements

The transit system will operate seven days a week from March through November. During the summer season (June - August) the Mather-Tusayan transit service will operate between the hours of 6 AM and 10 PM. Maximum vehicle headways of 10 minutes will be maintained during the off peak hours of the day. Between the hours of 10 PM and 6 AM transit service will be provided by a single bus operating on a one hour frequency. A separate on-demand dial-a-ride taxi service will also be available for a fee from the concessionaire between 10 PM and 6 AM.

During the shoulder seasons (September-November and March-May) the transit service will operate between the hours of 7AM and 9 PM. Maximum vehicle headways of 10 minutes will be maintained during the off peak hours of the day the same as during the summer season. Evening transit service between the hours of 9 PM and 7 AM transit service will be similar to the summer night operation with hourly service provided by a single bus.

During the winter season (December- February) the transit service will not operate. The Mather Parking area will be used by all visitors during the winter season eliminating the need for the Tusayan-Mather transit service.

5. Personnel Requirements

The personnel requirements have been estimated at a rate of 2.5 employees per active bus in the fleet (not counting spare buses). This estimate covers drivers, mechanics, and administrative personnel. The personnel estimates presented in TABLE 1 are based on the seasonal requirements in the years 2000 and 2010.

TABLE 1: Personnel Requirements

Year and Season	Maximum Active Fleet (Fleet minus spares)	Personnel Required
2000 Summer	9	23
2000 Shoulder	4	10
2010 Summer	12	30
2010 Shoulder	6	15

6. Capital Cost Estimate

The capital costs for the transit service include the rolling stock, a maintenance and a vehicle storage facility. The cost of the rolling stock is based on standard 45 foot-long diesel powered buses. One additional capital cost involves upgrading Highway 64 between Tusayan and Mather Point to handle the increased loading created by the passage of the new transit fleet.

Rolling Stock

The fleet sizing was performed using 80 passenger articulated buses. The cost for the rolling stock is based on the fleet requirements for the peak summer ridership demand. A unit price of $350,000 was estimated for each 45 foot bus that will be used on this system. The fleet requirements for the year 2000 are 11 buses. This fleet size will cost an estimated $3.85M. The ultimate fleet requirements for the 2010 demands will require a total fleet size of 14 buses that will cost approximately $4.9M.

To properly assess the cost of using the fleet, it is necessary to calculate an annual depreciation value for the fleet. This was accomplished using an average service life of 15 years for the vehicles and an 8% rate of interest. This yields an annual use fee for the fleet of about $450,000 for the fleet needed in the year 2000 ($3,850,000 x 0.11683 = $449,796/year). In the year 2010 the full fleet requirements will increase the annual fee to about $572,000 per year ($4,900,000 x 0.11683 = $572,467/year).

Maintenance Facility

The bus maintenance facility should be sized at the rate of one service bay per every 10 buses with a minimum of two bays. Each bay is estimated to be 2,000 sf. Additional space is required for tools, equipment, and parts. This space is estimated based on the number of service bays at the rate of 1,000 sf per bay. The administrative area for the transit operation will be included in the Maintenance facility. Maintenance facilities have been sized for the 2010 summer design values. An estimated unit price for the maintenance facility is $150 per square foot. (14 buses -- 2 bays x 3,000 sf = 6,000 sf building x $150/sf = $900,000)

In addition to the maintenance building, the bus fleet will also require a maintenance yard area for temporary vehicle storage and vehicle fueling. This area is anticipated to be paved and sized at the rate of 500 sf per bus. A cost of $200,000 per acre is estimated for the maintenance yard. (14 buses x 500 sf = 0.16 acres x $200,000/acre = $32,140)

The fleet will require a bus barn for night storage. The bus barn includes an unheated sheet metal building on a concrete slab floor with overhead lighting and electrical service only. The bus barn is sized based on 650 square feet per bus. A fleet of 14 buses will require a 9,100 square foot bus barn. Bus barns are estimated to cost approximately $20 per square foot. (14 buses x 650 sf = 9,100 sf x $20/sf = $182,000)

Highway 64 Overlay

To insure the integrity of Highway 64 along the transit route it is assumed that an asphalt overlay would be required. It is estimated that a three inch overlay would cost about $75,000 per mile of roadway. Therefore to overlay the six mile route along Highway 64 would cost about $450,000.

Capital Cost Summary

The following data summarizes the capital costs associated with the transit operation. The cost estimates shown in TABLE 2 are based on the 2010 design year needs and includes all infrastructure costs except the cost of the rolling stock. The estimated $1.564M capital cost investment will be annualized using a 20 year pay back period and 8% interest. This yields an annualized cost of about $160,000 per year ($1,564,000 x 0.10185 = $159,293/year).

TABLE 2: Capital Cost Estimate

Item	Units	Unit Price	Estimated Cost
Maintenance Building	6,000sf	$150/sf	$900,000
Maintenance Yard	0.16 acres	$200,000/acre	$32,000
Bus Barn	9,100sf	$20/sf	$182,000
Overlay Highway 64	6 miles	$75,000/mile	$450,000
TOTAL			**$1,564,000**

7. Operation and Maintenance Costs

The operation cost includes the labor, LNG fuel, parts and maintenance. The transit operators contacted as part of the research indicated a range of operational costs. The lowest rate was $2.50

per mile and the highest rate was $4.50 per mile. For the purposes of this analysis an O&M cost of $3.50 per mile was considered appropriate for the year 2000 and a rate of $4.00 per mile for the year 2010. The increase in the O&M rate is to account for inflation. For the purposes of this calculation the daily miles driven was estimated using 90% of the full service hour miles driven. (For example, in 2000 summer 9 buses x 12.5 miles x 2 trips per hour x 16 hours x 90% = 3,240 miles per day)

The annual operating cost for the system in the year 2000 is estimated to be about $1.95M and in the year 2010 about $3.145M. A breakdown of the O&M costs are shown in Table 3.

TABLE 3 : O&M Costs

Year and Season	Miles Driven Per Day	O&M Cost Per Day	O&M Cost Per Season
2000 Summer	3,240	$11,340	$1,031,940
2000 Shoulder	1,440	$5,040	$917,280
2000 Total			**$1,949,220/Year**
2010 Summer	4,320	$17,280	$1,572,480
2010 Shoulder	2160	$8,640	$1,572,480
2010 Total			**$3,144,960/Year**

8. Cost Per Visitor

A cost per visitor figure was developed using the 2010 data which includes the annual capital costs (20 year pay back with 8% interest) plus the O&M costs. This would be the fee that would have to be charged to each Park visitor to pay for the service. It is assumed that the cost of the transit system would by paid for by all visitors to the Park (North and South Rims, year-round) and not only the transit riders. The cost per visitor data is presented in Table 4.

TABLE 4: Cost Per Visitor

	Year 2000	Year 2010
Annual O&M Cost	$1,949,220	$3,144,960
Annual Capital Cost*	$159,293	$159,293
Annual Fee for use of Rolling Stock	$449,796	$572,467
Total Annual Cost	**$2,558,309**	**$3,876,720**
Projected Annual Visitation	5,182,384	6,865,000
Cost Per Visitor	**$0.49**	**$0.56**

* Does not include cost for using rolling stock.

9. Fleet Replacement Costs

The Park Service may desire to plan for the next generation of buses by assessing a fleet replacement fee. It is assumed that the next fleet will be needed in about 15 years and will cost considerably more than the present fleet due to inflation. Using a 3% annual inflation factor the next fleet is estimated to cost approximately $22.9M ($350,000 x 1.56 x 14 buses = $7,644,000). Using an 8% interest factor the annual fleet replacement fee would be about $893,000 ($7,644,000 x 0.11683 = $893,049). **If the annual fleet replacement fee were added to the per visitor cost it would yield a year 2000 cost of $0.66 per visitor and a year 2010 cost of $0.69 per visitor.**

TRANSIT SYSTEM COST ESTIMATE
TUSAYAN-MATHER POINT TRANSIT SYSTEM
GRAND CANYON NATIONAL PARK, ARIZONA

This document is intended to provide the members of the Grand Canyon GMT Implementation Team with updated information on the system costs related to the development and operation of a visitor transit system between Tusayan, AZ and Mather Point within the Park.

1. Ridership Projections

The following visitation assumptions were used in estimating projected ridership.

2000 Total Visitation = 5,182,384
2010 Total Visitation = 6,865,000
2000 South Rim Visitation = 4,722,259
2010 South Rim Visitation = 6,341,000

Using these visitation projections individual design day estimates were developed. The details of the design day assumptions are included in the previous tech memo date 9/24/96 titled "Design Parameters". A summary of the design day visitation and peak hour ridership demand estimates for the forecast years 2000 and 2010 is presented in TABLE 1.

TABLE 1: Peak Hour Ridership Projections

Year and Season	South Rim Design Day Visitation	Peak Hour Ridership Demand
2000 Summer	37,554 visitors	2,326 rides/hr
2000 Shoulder	26,288 visitors	1,628 rides/hr
2000 Winter	12,855 visitors	576 rides/hr
2010 Summer	45,000 visitors	2,781 rides/hr
2010 Shoulder	31,500 visitors	1,947 rides/hr
2010 Winter	15,404 visitors	732 rides/hr

Note that the shoulder season estimates are based on 70% of summer season visitation.

2. Tusayan-Mather Route

The Tusayan-Mather transit system will operate between two transit terminals, one at Mather Point and the other located north of the IMAX theater at the north end of Tusayan. The transit vehicles will use Highway 64 between the two terminals. This route will be shared with private vehicles who will also be using this highway. The round-trip travel time is estimated to be 30 minutes based on an average operating speed of 30 MPH and terminal stop times of three minutes per stop.

3. Transit Vehicle Requirements

The Mather-Tusayan transit service will be provided using a fleet of 45 foot long, single unit buses. These buses will be designed to have a low floor (14 inches or less) with four wide doors opening on the right side of the vehicle. The vehicle interior will be equipped with perimeter seating, thereby maximizing the space available for standees. The vehicle design passenger load will include 16 seated passengers plus 64 standees for a total capacity of 80 passengers.

The buses will be driven by a pair of electric traction motors connected directly to the rear tires. A hybrid power system will be used to produce the needed electricity for the traction motors. Initially the hybrid power source will consist of an on-board LNG fueled generator set and a battery pack. The genset will be sized to produce the average power required by the vehicle's duty cycle while the battery will provide the additional power required for peak demand periods.

The buses will be designed to be capable of conversion to fuel-cell power. At the time of the conversion the genset would be removed and replaced with a fuel-cell power plant. Original vehicle component parts such as the electric traction motors, battery packs and LNG fuel tanks will be designed to be compatible with the fuel cell power units.

The vehicles will not be air-conditioned but will be equipped with operable windows. The buses will be equipped with a public address system capable of providing good quality sound for audio interpretive presentations.

4. Fleet Requirements

All fleet sizing has been based on 45 foot single unit buses carrying a total of 80 passengers. The number of 45 foot buses required to accommodate the peak hour demand on the design day in the summer, shoulder and winter seasons in the years 2000 and 2010 are shown in TABLE 2.

TABLE 2: Fleet Requirements

Year and Season	Maximum Transit Demand	Active Buses Required	Headway	Fleet Requirements (Active plus spares)
2000 Summer	2,326 rides/hr	2,326/160=15	2 min.	15 + 3 = 18 buses
2000 Shoulder	1,628 rides/hr	1,628/160=11	2.75 min.	11 + 2 = 13 buses
2000 Winter	576 rides/hr	576/160= 4	7.5 min.	4 = 1 = 5 buses
2010 Summer	2,781 rides/hr	2,781/160=18	1.6 min.	18 + 3 = 21 buses
2010 Shoulder	1,947 rides/hr	1,947/160= 13	2.3 min.	13 + 2 = 15 buses
2010 Winter	732 rides/hr	732/160= 5	6 min.	5 + 1 = 6 buses

5. Transit Service Requirements

The transit system will operate seven days a week year round. During the summer season (June - August) the Mather-Tusayan transit service will operate between the hours of 6 AM and 10 PM.

Maximum vehicle headways of 10 minutes will be maintained during the off peak hours of the day. Between the hours of 10 PM and 6 AM transit service will be provided by a single bus operating on a one hour frequency. A separate on-demand dial-a-ride taxi service will also be available for a fee from the concessionaire between 10 PM and 6 AM.

During the shoulder seasons (September-November and March-May) the transit service will operate between the hours of 7AM and 9 PM. Maximum vehicle headways of 10 minutes will be maintained during the off peak hours of the day the same as during the summer season. Evening transit service between the hours of 9 PM and 7 AM transit service will be similar to the summer night operation with hourly service provided by a single bus.

During the winter season (December- February) the transit service will operate between the hours of 7 AM and 8 PM. Maximum vehicle headways of 15 minutes will be maintained during the off peak hours of the day during the winter season. Evening transit service between the hours of 8 PM and 7 AM will be similar to the summer night operation with hourly service provided by a single bus.

6. Personnel Requirements

The personnel requirements have been estimated at a rate of 2.5 employees per active bus in the fleet (not counting spare buses). This estimate covers drivers, mechanics, and administrative personnel. The personnel estimates presented in TABLE 3 are based on the seasonal requirements in the years 2000 and 2010.

TABLE 3: Personnel Requirements

Year and Season	Maximum Active Fleet (Fleet minus spares)	Personnel Required
2000 Summer	15	38
2000 Shoulder	11	28
2000 Winter	4	10
2010 Summer	18	45
2010 Shoulder	13	33
2010 Winter	5	13

7. Capital Cost Estimate

The capital costs for the transit service include the rolling stock, vehicle fuel requirements, and a maintenance and storage facility. There is also the cost for converting the fleet to fuel cell power. One additional capital cost involves upgrading Highway 64 between Tusayan and Mather Point to handle the increased loading created by the passage of the new transit fleet.

Rolling Stock

The fleet sizing was performed using 80 passenger articulated buses. The cost for the rolling stock is based on the fleet requirements for the peak summer ridership demand. A unit price of $400,000 was estimated for each 45 foot bus that will be used on this system. The fleet requirements for the year 2000 are 18 buses. This fleet size will cost an estimated $7.2M. The ultimate fleet requirements for the 2010 demands will require a total fleet size of 21 buses that will cost approximately $8.4M.

To properly assess the cost of using the fleet, it is necessary to calculate an annual depreciation value for the fleet. This was accomplished using an average service life of 15 years for the vehicles and an 8% rate of interest. This yields an annual use fee for the fleet of about $841,000 for the fleet needed in the year 2000 ($7,200,000 x 0.11683 = $841,176). In the year 2010 the full fleet requirements will increase the annual fee to about $981,000 per year ($8,400,000 x 0.11683 = $981,372).

Maintenance Facility

The bus maintenance facility should be sized at the rate of one service bay per every 10 buses with a minimum of three bays. Each bay is estimated to be 2,000 sf. Additional space is required for tools, equipment, and parts. This space is estimated based on the number of service bays at the rate of 1,000 sf per bay. The administrative area for the transit operation will be included in the Maintenance facility. Maintenance facilities have been sized for the 2010 summer design values. An estimated unit price for the maintenance facility is $150 per square foot. (21 buses -- 3 bays x 3,000 sf = 9,000 sf building x $150/sf = $1.35M)

In addition to the maintenance building, the bus fleet will also require a maintenance yard area for temporary vehicle storage and vehicle fueling. This area is anticipated to be paved and sized at the rate of 500 sf per bus. A cost of $200,000 per acre is estimated for the maintenance yard. (21 buses x 500 sf = 0.25 acres x $200,000/acre = $50,000)

The fleet will require a bus barn for night storage. The bus barn includes an unheated sheet metal building on a concrete slab floor with overhead lighting and electrical service only. The bus barn is sized based on 650 square feet per bus. A fleet of 21 buses will require a 13,650 square foot bus barn. Bus barns are estimated to cost approximately $20 per square foot. (21 buses x 650 sf = 13,650 sf x $20/sf = $273,000)

Fuel Cell Conversion

When fuel cell power units are available at some time around the year 2005 the fleet will be converted. During this process the gensets will be replaced by fuel cell units. The cost for the fuel cell conversion is estimated to be $300,000 per bus. (21 buses x $300,000 = $6,300,000)

Highway 64 Overlay

To insure the integrity of Highway 64 along the transit route it is assumed that an asphalt overlay would be required. It is estimated that a three inch overlay would cost about $75,000 per mile of roadway. Therefore to overlay the six mile route along Highway 64 would cost about $450,000.

Capital Cost Summary

The following data summarizes the capital costs associated with the transit operation. The cost estimates shown in TABLE 4 are based on the 2010 design year needs and includes all

infrastructure costs except the cost of the rolling stock. The estimated $8.873M capital cost investment will be annualized using a 20 year pay back period and 8% interest. This yields an annualized cost of about $900,000 per year ($8,873,000 x 0.10185 = $903,715).

TABLE 4: Capital Cost Estimate

Item	Units	Unit Price	Estimated Cost
Maintenance Building	12,000sf	$150/sf	$1,800,000
Maintenance Yard	0.25 acres	$200,000/acre	$ 50,000
Bus Barn	13,650sf	$20/sf	$ 273,000
Fuel Cell Conversion	21 buses	$300,000/bus	$6,300,000
Overlay Highway 64	6 miles	$75,000/mile	$450,000
TOTAL			**$8,873,000**

8. Operation and Maintenance Costs

The operation cost includes the labor, LNG fuel, parts and maintenance. The transit operators contacted as part of the research indicated a range of operational costs. The lowest rate was $2.50 per mile and the highest rate was $4.50 per mile. For the purposes of this analysis an O&M cost of $3.50 per mile was considered appropriate for the year 2000 and a rate of $4.00 per mile for the year 2010. The increase in the O&M rate is to account for inflation. For the purposes of this calculation the daily miles driven was estimated using 90% of the full service hour miles driven. (For example, in 2000 summer 15 buses x 12.5 miles x 2 trips per hour x 16 hours x 90% = 5,400 miles per day).

The annual operating cost for the system in the year 2000 is estimated to be about $43M and in the year 2010 about $5.87M.

TABLE 4 : O&M Costs

Year and Season	Miles Driven Per Day	O&M Cost Per Day	O&M Cost Per Season
2000 Summer	5,400	$18,900	$1,719,900
2000 Shoulder	3,465	$12,128	$2,207,205
2000 Winter	1,170	$4,095	$372,645
2000 Total			**$4,299,750/Year**
2010 Summer	6,480	$25,920	$2,358,720
2010 Shoulder	4,095	$16,380	$2,981,160
2010 Winter	1,460	$5,840	$531,440
2010 Total			**$5,871,320/Year**

9. Cost Per Visitor

A cost per visitor figure was developed using the 2010 data which includes the annual capital costs (20 year pay back with 8% interest) plus the O&M costs. This would be the fee that would have to be charged to each Park visitor to pay for the service. It is assumed that the cost of the transit system would by paid for by all visitors to the Park (North and South Rims) and not only the transit riders.

TABLE 5: Cost Per Visitor

	Year 2000	**Year 2010**
Annual O&M Cost	$4,299,750	$5,871,320
Annual Capital Cost*	$903,715	$903,715
Annual Fee for use of Rolling Stock	$841,176	$981,372
Total Annual Cost	**$6,044,641**	**$7,756,407**
Projected Annual Visitation	5,182,384	6,865,000
Cost Per Visitor	**$1.17**	**$1.13**

* Does not include cost for using rolling stock.

9. Fleet Replacement Costs

The Park Service may desire to plan for the next generation of buses by assessing a fleet replacement fee. It is assumed that the next fleet will be needed in about 15 years and will cost considerably more than the present fleet due to inflation. Using a 3% annual inflation factor the next fleet is estimated to cost approximately $22.9M ($700,000 x 1.56 x 21 buses = $22,932,000). Using an 8% interest factor the annual fleet replacement fee would be about $2.68M ($22,932,000 x 0.11683 = $2,679,146). **If the annual fleet replacement fee were added to the per visitor cost it would yield a year 2000 cost of $1.68 per visitor and a year 2010 cost of $1.52 per visitor.**

APPENDIX E: LIGHT RAIL - ALTERNATIVE C

The light rail alternative would utilize articulated light rail vehicles to transport visitors along a loop system from the Tusayan Gateway Center outside the park to Mather Point, Maswik Transportation Center and then back to Tusayan. With the loop system, a "local" route would also provide local transportation inside the park.

1. RIDERSHIP PROJECTIONS:

Primary Route

2000 Summer	2,880 passengers per hour
2000 Shoulder	as needed, up to 2,880 passengers per hour
2000 Winter	as needed, up to 2,880 passengers per hour
2010 Summer	2,880 passengers per hour
2010 Shoulder	as needed, up to 2,880 passengers per hour
2010 Winter	as needed, up to 2,880 passengers per hour

Local Route

Same as Primary Route

2. HEADWAYS (Time Between Vehicles)

Primary Route

Summer	10 minutes
Shoulder	15 minute
Winter	15 minutes

Local

Summer	15 minutes
Shoulder	15 minutes
Winter	15 minutes

Headways could easily be shortened to provide more frequent service if desired by Park Service.

3. ROUTE DESCRIPTIONS:

The primary route would begin at the Tusayan Gateway Center and proceed to Mather Point Center in approximately 10 minutes.

It would then proceed to the existing Maswik Transportation Center in approximately 8 minutes.

It would return to the Tusayan Center in approximately 8 minutes.

Entire running time, Including loading and unloading, would be approximately 30 minutes. The entire loop is approximately 13.5 miles, of which 4 miles is side by side in the same corridor.

The local route would make the following stops:

1. Mather Point
2. Yavapai Lodge/Cafeteria/General Store/Park Administration Building
3. Historic Grand Canyon Depot
4. Maswik Transportation Center
5. Park Maintenance Area
6. Campground/RV Area

The entire running time for the local route is approximately 15 minutes. The route is 5.6 miles.

4. TRANSIT VEHICLE DESCRIPTION

Regio Sprinter manufactured by Siemens Transportation Systems, Inc.

Height	11' 3"
Width	9' 7"
Width of right away	11' 6"
Width of Corridors	24' x 460'
Typical Operating Speeds	10 - 60 mph
Maximum Weight	50 tons
Engine	5 cylinder turbo charged inter-cooled diesel (Research is being done to determine cost of LNG engine.)
Passenger Capacity	84 seated (74 fixed and 10 fold-down) 180 standing (84 seated and 96 standing) 200 packed (84 seated and 116 standing)
Doors	4 automatically operated 4' 0" wide doors

5. FLEET REQUIREMENTS

8	Units for Primary Route
1	Unit for local Route
1	Spare
10	Total

6. OPERATING SCHEDULE

This service would operate 24 hours per day. Departures would be every 10 minutes In the summer and every 15 minutes in the shoulder and winter seasons between 6:00 am. and midnight. Service is proposed hourly between midnight and 6:00 a.m.

7. PERSONNEL REQUIREMENTS

2000	Summer	26
2000	Shoulder	20
2000	Winter	20
2010	Summer	26
2010	Shoulder	20
2010	Winter	20

8. CAPITAL COST ESTIMATE

Light Rail Vehicles	$11,000,000
Sub-grade and Track	8,000,000
Paving	2,200,000
Signal System	2,400,000
Engineering/Planning	1,000,000
Maintenance Facility	2,000,000
	$26,600,000

9. ANNUAL OPERATING AND MAINTENANCE COST

2000	$6,872,000
2010	$7,037,000

10. COST PER VISITOR

Year 2000

Annual Operating and Maintenance	$6,872,000
Annual Capital	2,709,000
Total Annual Cost	$9,581,000
Projected Visitation	5,182,384
Cost per Visitor	$1.85

Year 2010

Annual Operating and Maintenance	$7,037,000
Annual Capital	2,709,000
Total Annual Cost	$9,746,000
Projected Visitation	6,865,000

Cost per Visitor	$1.42

REGIO SPRINTER FACT SHEET

Height above top of rail	11.3 ft.
Width	10.0 ft.
Typical operating speeds	10 - 60 mph
Maximum weight	50 tons
Engine	50 cyl. turbo charged intercooled diesel
Pax capacity	90 seated 160 standing 200 crush
Doors	4 automatically operated doors 4' - 0" wide

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